

Classification of 11-13 yrs girls' motor fitness, considering level of physical exercises' mastering

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Abstract

Purpose: to determine the prospects of classification of 11-13 yrs girls' motor fitness, considering level of physical exercises' mastering.

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

Results: first function explains results' variation by 76.7%, second – by 23.3%. It witnesses that it is possible to classify girls' age distinctions, basing on motor fitness testing, considering level of physical exercises' mastering. Structural coefficients of first canonic discriminant function points that substantial difference between 11 and 12-13 yrs girls is observed in levels of speed, dynamic and static power; in motor coordination and level of acrobatic exercises' mastering.

Conclusions: analysis of canonic discriminant function's coefficients showed that system of children and adolescents' physical education has hierarchic structure. In this system, training of motor abilities depends on formation of motor skills.

Keywords: motor abilities, level of mastering, discriminant analysis, girls.

Introduction

The problem of schoolchildren physical education's optimization has been remaining relevant during recent decades. Demand in seeking new approaches to physical culture planning in comprehensive educational establishments is pointed at by researches of scientists [9]. The authors found tendencies of pupils' functional state changes, depending on systemic character of physical culture trainings and motor functioning in vacations. It was determined that planning of educational process requires certain periodizing of pupils' physical training according to their adaptation potentials [9]. I. Bondar points at relevance of integrative physical education of different health groups' pupils [1]. Yu. Vaskov regarded theoretical aspects and conditions of implementation in educational process such innovative approaches as cultural, competence, synergetic, axiological and achmeological. The author opened ways of the mentioned approaches' implementation in real educational process. The author proved, that implementation of innovative approaches facilitate improvement of educational process's organization on the base of personality-oriented approach to pupils [2].

In schoolchildren's physical education there are other directions, connected with study of the following: training of strength [5, 7]; schoolchildren's functional and coordination fitness [6] gymnastic exercises' training [17]; mastering of gymnastic and light athletic exercises [20, 28]. The authors found: special aspects of functional, coordination and power fitness of children and adolescents [4, 11]; they determined dependence of power loads' training effects on regimes of exercises' fulfillment and rest [18, 23]. The process of motor actions training was studied from positions of inter-disciplinary connections. Influence of training methodic for skills and abilities with application of inter-disciplinary connections on motor

fitness in light athletic was found [12, 13]. In other studies it was determined: special aspects of verbal information influence on formation of children's and adolescents' motor skills [14]; formation of motor competence [15]; formation of meta-cognitive behavior [16]; verbal perception in the process of sport movements' mastering [19]; optimization of exercises' repetition regimes and rest intervals in motor skills' formation [20, 26, 28].

In available scientific literature there are a few data about wholeness of motor skills' training and education of children and adolescents [27, 29]. Thus, study of prospects of classification of 11-13 yrs girls' motor fitness, considering mastering level of physical exercises, is rather relevant.

The purpose of the research is to study the prospects of classification of 11-13 yrs girls' motor fitness, considering level of physical exercises' mastering.

Material and methods

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

Organization of the research: we registered: body height, body mass, vital capacity of lungs, right and left hand dynamometry. Results of the following tests were registered: "Pressing ups in lying position, times", "Chin ups in lying position, times", "Legs' rising on wall bars, times", "Angle, resting on parallel bars, sec.", "Torso rising in sitting position from lying position during 1 min., times", "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 jumps from the spot, cm", "Throw of filled ball (1 kg) from sitting position, cm", "Shuttle run 4x9 m, sec" [25].

Mastering of gymnastic exercises was found with the following: "Forward roll", "Backward roll", "Vault", "Rope climbing, three times", "Bridge", "Stance on

shoulder blades” [27].

Statistical analysis: processing of the research material was carried out with the help of IBM SPSS 20 program. Discriminant analysis helped to create prognostic model of belonging to group. This model builds discriminant function (or set of discriminant functions, if they are more than two) in the form of predictors-variables linear combination. It ensures the best groups’ distribution. These functions are built basing on set of observations, belonging to groups of which is known. Further, these functions can be applied to new observations with known predictors-variables and unknown group belonging.

For every canonic discriminant function we calculated own value, dispersion percentage, canonic correlation, Wilks’ Lambda, χ^2 - Chi-square.

Results

Results of the research are presented in tables 1-5.

The first canonic function explains variation of results by 76.7 %; the second – by 23.3 %. It witnesses about high informational potential of first and second canonic functions ($r_1 = 0.919$; $r_2 = 0.789$) (see table 1). In table 2 we give material of canonic functions’ analysis. The first line contains value $\lambda = 0.059$ and statistical significance $p = 0.001$ for all set of canonic functions. The second line contains the data after excluding first function ($\lambda = 0.378$; $p = 0.001$). The first and the second functions have high discriminant potential and meaning in interpretation in respect to general communality.

In table 3 normalized coefficients of canonic discriminant function are given. In the first canonic function with the highest contribution variables, which characterize physical condition, dynamic and static strength, are included. In the second canonic function with the highest contribution variables, which characterize speed-, dynamic and static strength, motor coordination and level of acrobatic exercises’ mastering, are included.

Structural coefficients of first discriminant function (coefficients of variables’ correlation with function) witness that this function is most of all connected with the following variables: physical condition; speed-, dynamic and static strength; level of physical exercises’ mastering. Structural coefficients of second discriminant

function points that this function is mostly connected with flexibility and level of “Stance on shoulder blades” mastering (see table 3).

In table 4 we present results of classification of girls’ motor fitness, considering level of physical exercises’ mastering: 95.8 % of outcome grouped observations are classified correctly. Thus, canonic discriminant function can be used for determination of special aspects of control over training process and development of children’s and adolescents’ motor skills.

Diagram in fig. 1 witnesses about density of objects inside every class and about expressed boarder between classes. On positive pole of first function there are centroids of 13 yrs girls’ state; on negative pole - there are centroids of 1q yrs girls’ state. It shows that classification of 11-13 yrs girls’ motor fitness, considering the level of physical exercises’ mastering, permits to regard system of children’s and adolescents’ physical education as a hierarchic system. In this system development of motor abilities obeys to the process of motor skills’ formation (see fig. 2).

Discussion

In the present research we regarded assumption about wholeness of motor abilities’ development and training from positions of systemic approach [3, 8].

Earlier it was found that results’ variation in total dispersion of 11-13 yrs girls by 81.259%, 79.353%, and 71.019% depends on motor fitness and level of physical exercises’ mastering. In factorial structure level of physical exercises’ mastering contributes 16.435% (11 yrs), 27.963% (12yrs) and 17.010% (13 years). Analysis of communalities showed that in 11-13 yrs girls development of motor abilities is effective [31]. The given results characterize connections of functioning (by terminology of systemic approach) [3].

The received data characterize connections of development and point that system of children’s and adolescents’ physical education has hierarchic structure. In this system motor abilities’ development obeys to process of motor skills’ formation (see fig. 2).

The mentioned data supplement results of Xu X. [30] and Ye. Repko about influence of physical characteristics on motor skills’ formation in primary schoolchildren [10];

Table 1. Canonic discriminant function. Own values

Function	Own values	% of explained dispersion	Cumulative %	Canonic correlation
1	5.430	76.7	76.7	.919
2	1.645	23.3	100.0	.789

Table 2. Canonic discriminant function. Wilks’ Lambda,

Functions’ check up	Wilks’ Lambda,	Chi-square.	Degrees of freedom	p
from 1 to 2	.059	437.819	44	.000
2	.378	150.297	21	.000

Table 3. Coefficients of canonic discriminant function

№		Normalized coefficients		Structural coefficients	
		Function 1	Function 2	Function 1	Function 2
1	Body height, cm	.341	-.152	.444*	-.022
2	Body mass, kg	-.123	-.117	.262*	-.011
3	Vital capacity of lungs (VCL) cm ³	.102	.232	.258*	-.056
4	Right hand dynamometry, kg	.159	.000	.316*	-.080
5	Left t hand dynamometry, kg	-.088	-.109	.268*	-.130
6	Pressing ups in lying position, times	-.472	.081	.222*	-.092
7	Chin ups in lying position, times	.245	-.446	.436*	-.085
8	Legs' rising on wall bars, times	-.244	.688	.213*	.049
9	Angle, resting on parallel bars, sec.	-.536	-.406	-.070*	-.200
10	Torso rising in sitting position from lying on back position during 1 minute, times	.455	-.379	.298*	-.234
11	Forward torso bending from sitting position with feet apart, cm	.008	.513	-.017	.362*
12	Hanging on bent arms, sec.	.469	.159	.390*	.050
13	Torso rising from lying on abdomen position during 30 sec., times	.548	-.149	.405*	-.271
14	Long jump from the spot, sm	.059	.554	.369*	.343
15	Throw of filled ball (1 kg) from sitting position, cm	.490	.354	.519*	.243
16	Shuttle run 6ir 4x9 m, sec.	-.181	.471	-.231*	.249
17	Forward roll, mastering level	-.184	.579	.198*	-.052
18	Backward roll, mastering level	.184	-.446	.260*	-.162
19	Vault, mastering level	-.060	-.138	.288*	-.023
20	Rope climbing three times, mastering level	-.133	.188	.224*	-.078
21	Bridge, mastering level	-.464	.068	-.016*	-.109
22	Stance on shoulder baldes, mastering level	.042	-.366	.249	-.300*

Table 4. Results of classification

	Age	Predicted belonging to group			Total	
		11,00	12,00	13,00		
Outcome data	Frequency	11.00	51	0	0	51
		12.00	2	50	2	54
		13.00	1		2	63
		11.00	100.0	.0	.0	100.0
	%	12.00	3.7	92.6	3.7	100.0
		13.00	1.6	3.2	95.2	100.0

Khudolii O.M. about factors, influencing on effectiveness of gymnastic exercises' mastering [28].

The fulfilled discriminant analysis permitted to regard the processes of motor abilities' development and training as one. It supplements the data of other authors [21, 22] about effectiveness of multi-dimensional analysis application in physical education. Analysis of canonic function's normalized and structural coefficients permitted to find the role of one or another indicator in the structure of the process. It points at need in application of multi-dimensional methods of mathematical statistic in studying laws of children's and adolescents' physical education [24, 25].

Analysis of first and second canonic functions showed that in classification of 11-13 yrs girls' motor fitness it is necessary to consider the level of physical exercises' mastering. In table 5 we present point-by-point statistics of classification of 11-13 yrs girls' motor fitness. These data witness that 95.8% of outcome grouped observations were classified correctly.

So, discriminant analysis permitted to answer the question: how confidently it is possible to separate one class from other basing on set of offered variables; which of these variables influence the most substantially on recognition of classes; to which class object belongs on the base of discriminant variables.

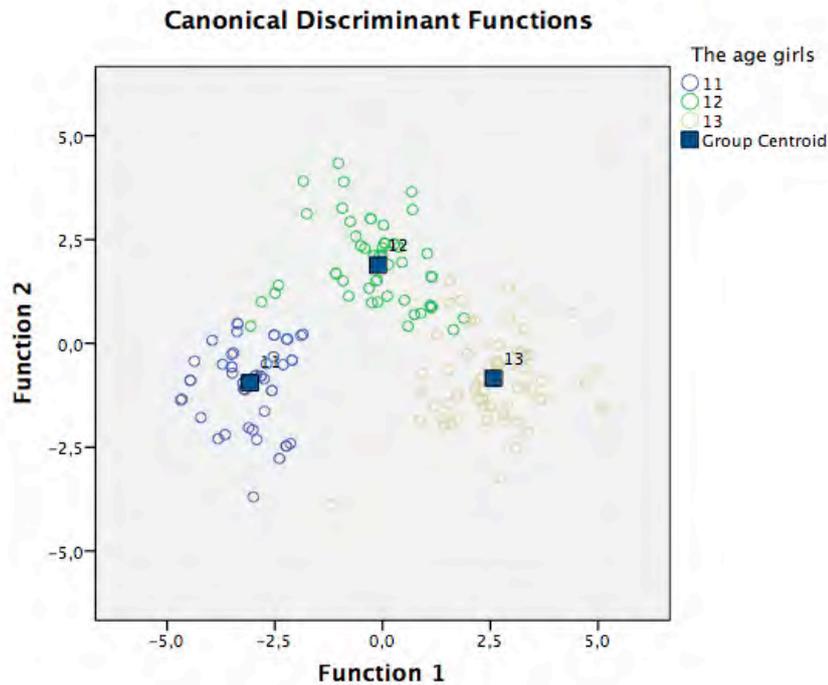


Fig.1 Canonic discriminant functions. Diagram of results of classification of 11-13 yrs girls' motor fitness, considering the level of physical exercises' mastering



Fig. 2. Diagram of motor abilities' development and process of motor skills' formation in 11-13 yrs girls

Table 5. Point-by-point statistics

Observation number	Actual group	The most confident group		P(G=g D=d)	Square of Mahalonobis distance to center
		Predicted group	P(D>d G=g) p +		
1	11	11	.861 2	1.000	.300
2	11	11	.218 2	.812	3.051
3	11	11	.237 2	1.000	2.879
4	11	11	.995 2	1.000	.010
5	11	11	.404 2	.934	1.810

Conclusions

Normalized coefficients of canonic discriminant function permit to find correlation of variables' contribution in function's result. The first function explains results' variation by 76.7% ($p < 0.001$), the second – by 23.3% ($p < 0.001$). It proves that it is possible to classify age distinctions of 11-13 yrs girls, basing on motor fitness testing, considering level of physical exercises' mastering..

Structural coefficients of first canonic discriminant function point that significant difference between 11 and 12-13 yrs girls is observed in the following: speed-, dynamic and static strength; motor coordination and mastering of acrobatic exercises. Structural coefficients of second canonic discriminant function point that substantial difference between 12 and 13 yrs girls is observed in flexibility and level of "Stance on shoulder blades" mastering.

Analysis of canonic discriminant functions' coefficients shows that the received data characterize correlations of development. System of children's and adolescents' physical education has hierarchic structure, in which development of motor abilities obeys to motor skills' formation.

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Conflict of interests

The author declares that there is no conflict of interests.

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