METHODIC OF PEDAGOGIC CONTROL OF 16-17 YEARS' AGE GIRLS' MOTOR FITNESS

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Abstract. Increase of schoolchildren's motor fitness is connected with organization of pedagogic control at physical culture lessons. It was assumed that the basis for pedagogic control of 16-17 years' age girls' motor fitness was discriminant model. *Purpose:* to determine methodological approaches to pedagogic control of 16-17 years' age girls' motor fitness. *Material:* in the research 28 senior form girls (fourteen 16 years' age 14 girls of 17 years' age girls) participated. Materials of the research were processed in statistical analysis program— IBM SPSS 20. *Results:* in the process of discriminant analysis we created prognostic model for belonging to group. This model builds discriminant function in the form of linear combination of predicting variables, which ensures the best division of groups. Correlation coefficient between calculated values of discriminant function and indicators of belonging to group was r=0.843 and witnesses about high prognostic potential of first canonic function. *Conclusions:* 16 years' age girls have better speed-power fitness than 17 years' girls. It points at the fact that in 17th years' age the reason of lagging behind 16 years' age girls is their insufficient motor activity. On the base of canonic coefficients of discriminant function it is possible to classify 16 and 17 years' age girls by level of their motor fitness, according to their age. It is of practical importance for working out effective programs of senior form girls' physical training. Discriminant model can be used for pedagogic control of 16 and 17 years' age girls' fitness.
Key words: discriminant, function, function, motor, fitness, modeling, girls.

Introduction

Increase of schoolchildren's motor fitness is connected with organization of pedagogic control at physical culture lessons [8, 9], selection of test tasks and working our control normative [1, 11, 12] as well as by methodological approaches to control of children's and adolescents' motor fitness [5, 6, 7, 10]. Classification of motor and functional fitness is a component of pedagogic control. Taking decision in control over children's and adolescents' physical education depends on it [13, 16, 24]. The authors show potentials of classification of girls' age distinctions on the base of functional and coordination fitness testing [13]. The authors found that in factorial model of motor fitness complex training of motor abilities, general coordination; coordination of different body parts' movements, vestibular stability are distinguished [24].

One of classification methods can be discriminant analysis [26, 27]. It permits to maximally exactly divide pupils into groups [25]. On the base of such approach recreational-health related technology for pupils' health improvement can be offered [27].

In previous works it was found that discriminant analysis can be effectively used in classification of boys and girls of secondary [23, 24, 28] and senior forms [21, 22]. The received data point at prognostic significance of discriminant function in assessment of schoolchildren's motor and functional fitness [7].

However, in available scientific literature insufficient attention is paid to modeling method for classification of school age girls' motor and functional fitness.

Hypothesis of the research: it was assumed that the basis for pedagogic control of 16-17 years' age girls can be discriminant model.

The purpose of the research: to determine methodological approaches to pedagogic control of 16-17 years' age girls' motor fitness.

Material and methods

Participants: in the research 28 senior form girls (fourteen 16 years' age 14 girls of 17 years' age girls) of gymnasium No.144 (Kharkov) participated.

Organization of the research: testing program included common tests, given in table 1 [8, 11, 12, 14, 15]. For assessment of functional state we used Shtange's, Genchy's and Serkin's tests [3].

Statistical analysis: the materials of the research were processed in statistical analysis program— IBM SPSS 20. In the process of discriminant analysis we created prognostic model for belonging to group. This model builds

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discriminant function (or, if there are more than two groups – a set of discriminant function) in the form of linear combination of predicting variables, which ensures the best division of groups. These functions are built by a set of observations, for which belonging to group is known. Further, these functions can be used for new observations with known predicting variables with unknown group belonging. For every variable the following statistics are calculated: mean values; standard deviations; single-factorial dispersion analysis for every variable (Box's M test; in-group correlation matrix; in-group co-variation matrix; co-variation matrixes for separate groups; general; co-variation matrix). For every canonic discriminant function we calculated: own value; dispersion percentage; canonic correlation; Wilks' Lambda; χ- Chi-square. For every step: a-priori probabilities; coefficients of Fisher's function; non-standardized coefficients of function; Wilks' Lambda for every canonic function were determined.

Results of the research

In table 1 we gave comparative analysis of 16-17 years' age motor and functional fitness. !6 years' girls showed better results in long jump from the spot. They made less mistakes in assessment of run time for 5 seconds ($p<0.05$). By results of other indicators the difference is statistically unconfident ($p>0.05$).

Table 1. Results of analysis of 16-17 years' age girls' motor and functional fitness

№	Description	16 years' girls		17 years' girls		t, p
		X	s	X	s	
1	Jumps with addings, times	3.588	.374	2.833	.405	p>0.05
2	Long jump from the spot, cm	195.882	4.368	176.917	8.198	2.204; p<.05
3	Long jump from the spot for 1/3 from maximal effort	18.007	3.128	23.317	6.318	p>0.05
4	Long jump from the spot for 1/2 from maximal effort	15.479	2.399	10.441	1.981	p>0.05
5	Long jump from the spot for 2/3 from maximal effort	9.369	1.822	13.325	2.462	p>0.05
6	5 sec. run, mistake in seconds	.429	.065	.725	.088	-2.748; p<.05
7	10 sec. run, mistake in seconds	1.04	.183	.90	.192	p>0.05
8	20 sec. run, mistake in seconds	2.176	.447	2.0	.353	p>0.05
9	Shuttle run 4x9 sec.	9.394	1.314	7.958	1.706	p>0.05
10	Pressing ups, times	6.176	.665	8.417	1.010	p>0.05
11	Chin ups, times	2.529	.429	3.083	.608	p>0.05
12	Hanging on bent arms, sec.	18.294	1.338	15.917	2.524	p>0.05
13	Shtange's test, sec.	48.529	3.676	45.0	3.963	p>0.05
14	Genchy's test, sec.	30.294	1.441	28.833	1.718	p>0.05
15	Serkin's test, 1st phase, sec.	39.235	2.890	35.833	2.197	p>0.05
16	Serkin's test, 2nd phase, sec.	18.823	1.829	22.083	1.653	p>0.05
17	Serkin's test, 3rd phase, sec.	36.235	3.544	30.750	2.181	p>0.05

For determination of distinctions between total results of 16-17 years' age girls' motor and functional fitness indicators we carried out discriminant analysis. Results are given in tables 2-4.

The first canonic function explains variation of results by 100%. This fact witnesses about their high informative potential (see table 1). Correlation coefficient between calculated values of discriminant function and indicators of belonging to group was r=0.843. It witnesses about high prognostic potential of first canonic function. The first canonic function's own value witnesses about its successfully selected coefficients.

Table 2. Canonic discriminant function. Own values.

Function	Own values	% of dispersion	explained	Cumulative %	Cnonic correlation
1	2.454	100.0		100.0	.843

In table 2 we provide results of canonic function's analysis. The first row contains values λ=0.290 and statistical significance p=0.05 for all canonic functions. The first function has high discriminant potential and values in interpretation in respect to general population.

Table 3. Canonic discriminant function. Wilk's Lambda

Checking of function	Wilk's Lambda	χ-Chi-square	Degrees of freedom	p
1	.290	22.931	17	.050

In table 3 we presented results of groups' classification (93.1% of the data were classified correctly). So, discriminant analysis permitted to answer the question: how confidently we can distinguish one class from other by set of the offered variables; which of these variables influence on classes' distinguishing the most substantially; to which class object belongs on the base of discriminant variables' values.

Table 4. Results of groups' classification

	Classificator (age, years)	Predicted belonging to group (age, years)		Total	Function value in groups' centroids
		16	17		
%	16	100.0	.0	100.0	1.270
	17	16.7	83.3	100.0	-1.799

Discussion

For practical application of discriminant analysis results coefficients of canonic discriminant function are used (see table 4). In table 5 we give information about discriminant function values for first 5 cases and belonging to one of groups is determined. Value P (G=g | D=d) is a measure of belonging to one of groups. I.e. it is a probability of the fact that certain case belongs to the predicted group. This group is calculated on the base of placing variables' values in corresponding to this case, function.

Table 5. Coefficients of canonic discriminant function

Description	Function 1
Jumps with addings, times	.065
Long jump from the spot, cm	.066
Long jump from the spot for 1/3 from maximal effort	-.003
Long jump from the spot for 1/2 from maximal effort	.106
Long jump from the spot for 2/3 from maximal effort	-.080
5 sec. run, mistake in seconds	-1.100
10 sec. run, mistake in seconds	1.393
20 sec. run, mistake in seconds	-.591
Shuttle run 4x9 sec.	.138
Pressing ups, times	.044
Chin ups, times	.368
Hanging on bent arms, sec.	-.134
Shtange's test, sec.	-.027
Genchy's test, sec.	.250
Serkin's test, 1st phase, sec.	-.018
Serkin's test, 2nd phase, sec.	-.130
Serkin's test, 3rd phase, sec.	.073
(Constant)	-18.552

Table 6. Statistic for separate cases

	№	Actual group	First group					Second group			Discriminant points
			Predicted group	P(D>d G=g) p	df	P(G=g D=d)	Square Mahalonobis distance center	Group to	P(G=g D=d)	Square Mahalonobis distance center	Function 1 to
Data	1	17	17	.707	1	.996	.141	17	.004	11.867	-2.175
	2	17	17	.014	1	1.000	5.987	16	.000	30.424	-4.246
	3	17	16**	.156	1	.668	2.015	17	.332**	2.721	-.150
	4	17	17	.298	1	.999	1.084	16	.001	16.893	-2.840
	5	17	17	.230	1	.663	1.441	16	.337	3.491	-.599

Analysis of the received results witnesses that 16 years' age girls have better speed-power fitness than 17 years' girls. It points at the fact that the reason of 17 years' girls' lagging behind 16 years' girls is reduction of motor functioning.

The received results expand information about development of children's and adolescents' motor abilities as well as about possibility to receive new information with the help of modeling method (S.S. Iermakov [4]; Adashevskiy V.M., Iermakov S. S. [17]; Khudolii O.M., Ivashchenko O.V. [16]; Vlasov A., Demichkovskiy A., Ivashchenko O., Lopatyev A., Pityn M., P'anylo Ya., Khudolii O. [2]).

For analysis of motor fitness we used discriminant model. Effectiveness of discriminant function usage in classification of motor and functional fitness was proved in works by Geoffrey D. Broadhead and Gabie E. Church [19], Dorita Du Toit, Anita E. Pienaar & Leani Truter [18], Khudolii O.M., Ivashchenko O.V. [16]. The obtained data also point at prognostic significance of discriminant function in assessment of 16-16 years' age girls' motor and functional fitness.

In researches on physical education and sports multi-dimensional models and methods are used for classification of disciples by motivation for sport practicing (Milić, M., Milavić, B., & Grgantov, Z. [33]), by motor functioning (Gert-Jan de Bruijn and Benjamin Gardner [20]), for classification of groups into sportsmen and not sportsmen (Lulzim I. [32]), for determination of dynamic of 9-12 years' age children condition under influence of fitness program (Dorita Du Toit, Anita E. Pienaar & Leani Truter [18]), for summarizing control of children's and adolescents' functional and motor fitness [6, 7, 29]. Geoffrey D. Broadhead And Gabie E. Church [19] point at possibility of discriminant analysis usage for classification of 5-12 years' age children's motor activity, depending on its volume. Equations of discriminant function permit to classify correctly 93% of grouped data.

The received results supplement scientific data about demand in structural [24, 25, 29] and functional analysis [16, 21] of children's and adolescents' motor fitness. These results prove the idea that discriminant model [22, 23, 28] can be used for pedagogic control of fitness level of 16-17 years' age girls.

The prospects of further researches imply determination of effectiveness of discriminant function usage in planning children's and adolescents' physical loads.

Conclusions

16 years' age girls have better speed-power fitness than 17 years' girls. It points at the fact that 17 year's age girls lag behind 16 years' girls owing to less motor functioning.

On the base of canonic discriminant function's coefficients it is possible to classify 16 and 16 years' age girls by motor fitness according to their age. It is of practical importance for working out physical training programs for senior school age girls. Discriminant model can be used for pedagogic control of 16-17 years' age girls' fitness.

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Conflict of interests

The author declares that there is no conflict of interests.

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