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INFORMATIVE INDICATORS OF 14-15 YEARS' AGE BOYS' MOTOR FITNESS

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Abstract
The purpose of the research is to determine informative indicators for in-group and intra-group control of 14 and 15 years' age boys' motor fitness.
Material & methods: in the research 112 schoolchildren participated: 14 years' age (n=44), 15 year' age (n=68). The materials of the research were processed in program of statistical analysis IBM SPSS 20. Factorial analysis as well as discriminant were fulfilled.
Results of the research: it was found that for control of motor fitness the most informative indicators were indicators of static power endurance and physical condition. It was also found that results of test "keeping angle on parallel bars" made the highest contribution in function's change and the closest correlation with the function.
Conclusions: 14 years' boys have better indicators of static and relative strength than 15 years' age boys. It points at the fact that in 15 years' age sharp changes of body mass, weight as well as reduction of motor functioning are the reasons of lagging behind. The received data witness that factorial and discriminant analysis can be methodological base for determination of tests' in-group and intra-group informational potential. For comprehensive control of motor fitness test "Keeping of angle on parallel bars" can be recommended.
Key words: motor fitness; informative tests; factorial; discriminant analysis; boys of 14 and 15 years' age.

Introduction

Analysis of scientific literature shows that the problem of children and adolescents' motor functioning optimization is relevant both in Ukraine (Baltsevych, & Zaporozhanov, 1987; Linec, 1997; Krutsevych, & Bezverkhnya, 2010; Khudolii, & Ivashchenko, 2014), and in European countries (Dorita, Anita, & Leani, 2011; Gert-Jan, & Benjamin, 2011; Cieślicka, Napierała,& Zukow, 2012; Chia, & Lee, 2015; Pop, 2016).

Optimization of physical education in comprehensive school implies such organization of teaching process, in which special aspects of pupils' motor and functional fitness, physical condition and their health are considered (Liakh, 2000; Arefiev, 2014; Logan, Robinson, Rudisill, Wadsworth, & Morera, 2014; Skidan, Sevdalev, & Vrublewskiy, 2015).

In different researches it was found that the following knowledge is required for optimization of pupils' physical education:

Peculiarities of motor abilities development (Ivashchenko, Karpunec, Krinin, 2014; Ivashchenko, & Spesivcev, 2015; Khudolii, Ivashchenko, & Chernenko, 2015; Marchenko, & Golubov, 2015; Moroz, 2015; Sanzharova, & D'iakova, 2015; Solodovnikova, 2015; Sribnij, 2016);

Regulations of physical exercises' training (Khudolii, 2008, 2009; Khudolii, & Chernenko, 2013; Khudolii, Ivashchenko, & Chernenko, 2013; Khudolii, O.M., Ivashchenko, 2014a, 2014b; Iermakov et al., 2016; Kozina, Sobko, Yermakova, Cieslicka, Zukow, Chia, Goncharenko, Goncharenko, & Korobeinik, 2016);

Knowledge of training and health related effect of physical loads (Khudolii, O.M., Ivashchenko, O.V., & Beketov, 2015; Ivashchenko, Khudolii, Titarenko, & Skorniakov, 2016; Korobeynikov, Korobeynikova, Iermakov, & Nosko, 2016; Nosko, Razumeyko, Iermakov, & Yermakova, 2016; Podrigalo, Iermakov, Rovnaya, Zukow, & Nosko, 2016);

Methodologies of pedagogic control over children's and adolescents' physical education (Krucevich, Vo-

robjov, & Bezverkhnia, 2011; Khudolii, & Ivashchenko, 2014; Ivashchenko, Iermakov, Karpunec', Krinin, & Nazarenko, 2015; Ivashchenko, Khudolii, Iermakov, Chernenko, & Golovko, 2015; Starchenko, 2015; Bodnar, & Andres, 2016; Ivashchenko et al., 2016; Khudolii, Ivashchenko, Iermakov, & Rumba, 2016; Ivashchenko, Khudolii, Iermakov, Lochbaum, Cieslicka, Zukow, Nosko, & Yermakova, 2016);

Knowledge about kinds of motor activity and its influence on children's and adolescents' physical condition (Kravchuk, & Golivec', 2015; Golenkova, & Skrigin, 2015; Golenkova, & Galkina, 2015; Sanzharova. & Kropivka, 2015; Kashuba, Goncharova, & Butenko, 2016; Kretschmann, 2016; Pryimakov, Iermakov, Kolenkov, Samokish, & Juchno, 2016);

About motivation for physical culture practicing (Krutsevych, & Bezverkhnya, 2000; Vedmedenko, 2005; Salman, 2006 Bliznevsky et al., 2016; Kozina et al., 2016; Shypulo, 2015).

Krutsevych and Bezverkhnya, (2000), Mosijchuk (2004), Vedmedenko (2005), Salman (2006) point that in adolescents' age there is significant reduction of motor functioning together with weak interest in physical culture lessons at school and negative attitude to physical culture in general.

In spite of numerous works (Krucevich, 2000; Andrieieva, 2002; Shevciv, 2009; Kozak, & Ibraimova, 2014; Lutovinov, Martin, Oleshko, Lisenko, & Tkachenko, 2014; Yaremenko, 2014), it is still important to solve the problem of effective ways for children's and adolescents' motor functioning intensification and their physical fitness improvement at the account of modern health related physical culture technologies, which would facilitate positive motivation for physical culture; form foundations of independent health related activity both in system of school education and in out-of-classes time.

That is why solution of pedagogic control questions on the base of schoolchildren's motor fitness characteristics is rather important.

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

Material & methods

Participants: in the research 112 schoolchildren participated: 14 years' age (n=44), 15 year' age (n=68), from comprehensive school No.22 (Kramatorsk).

The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance with the tenets of the Helsinki Declaration (WMA Declaration of Helsinki, 2016). The study protocol was approved by the Ethical Committee of University.

Procedure: testing program included commonly known tests (Khudolii, & Ivashchenko, 2011; Khudolii, Ivashchenko, & Karpunec', 2012). Testing program consisted of:

Test 1, for body mass:

Equipment: medical electronic weighing machine, which measures weight in kg with preciseness up to 50 g.

Description of test: During weighing participant stands on the middle of weighing machine platform, keeping calm position. In the process of operation weighing machine is verified for preciseness and sensitivity with the help of calibrated loads. Pupils' body mass shall be measured with pupils' being without upper dress and shoes.

Results: body mass with accuracy up to 50 g.

Test 2, for body length in standing position:

Equipment: height meter with scale in centimeters. Body height is measured in standing position with accuracy up to 0.5 cm.

Description of test: participant shall stand touching height meter by three points: heels, buttocks and shoulder blades. Head shall be kept so that conventional line, connecting low edge of eye-pit and antilobium, would be parallel to floor. The plank of height meter shall be dropped to the contact with pupil's head.

Results: mark on height meter is registered (with accuracy up to 0.5 cm).

Test 3, for keeping angle on parallel bars: it permits to determine general endurance.

Equipment: parallel bars, stop-watch with accuracy up to one/tenth of second, mat, registration table, chair.

Description of test: pupil takes stance on parallel bars, resting on them with hands. By command: "go" he directs legs forward upward, fixing legs' position at the level of bars. Legs shall not be bent in knees. Keep this position as long as possible.

Results: time of keeping angle with accuracy up to 0.1 sec.

Tests 4-5, for left and right hands' strength:

Equipment: hand dynamometer, box with gymnastic chalk, registration table and chair.

Description of test: after covering hands with gymnastic chalk participant takes dynamometer; it shall be on one line with forearm on thigh. The second joints of fingers shall be close to handle, in order that all weight of the dynamometer should be applied to the joints. Then the participant grips dynamometer between fingers and palm, moves arm aside and presses the tool with maximal effort.

Results: the strength is registered in kilograms.

Test 6, pressing ups in lying position:

Equipment: flat wooden or ground site, registration table, chair.

Description of test: participant takes lying position with palms resting on floor. Arms are straight-

ened; hands are placed at shoulder width with fingers directed forward. Torso and legs make straight line with feet toes resting on floor. By command "go" the participant starts rhythmically bend and unbend arms.

Result: quantity of correct pressing ups in one attempt.

Test 7: chin ups. This test is for control of pupils' dynamic strength.

Equipment: horizontal bar of 2-3 cm diameter, bench, gymnastic chalk. The height of horizontal bar location shall permit for participant to hang on straightened arms.

Description of experiment: participant stands on bench and grips horizontal bar from upward (palms directed forward) at shoulder width; then he hangs on arms (feet do not touch the floor). By command "go" he starts chin ups with full amplitude.

Result: quantity of correct chin ups in one attempt.

Test 8 – long jump from the spot. This test is for determination of schoolchildren's speed-power abilities.

Equipment: not slippery surface with marking in centimeters and start line.

Description of test: participant stands touching start line with toes; pushing by legs and waving arms he jumps forward as far as possible.

Results: the length of jump, the best of two attempts.

Test 9 – forward raising of legs up to 90° hanging on Swedish wall.

Equipment: Swedish wall or horizontal bar of 2-3 cm diameter, bench, gymnastic chalk. Horizontal bar shall be located so that participant could hang on straightened arms.

Description of test: the test is to be fulfilled on Swedish wall or on horizontal bar of 2-3 cm diameter. The participant shall raise legs up to 90° angle or higher. Legs shall not be bent in knees.

Result: the quantity of legs' raising up to 90° angle or higher; pause between each raising shall be not more than 1 sec.

Test 10 – forward torso bending from sitting position. This test is for backbone flexibility.

Equipment: drawn on floor line AB and perpendicular to it marking line in centimeters (from 0 to 30 cm).

Description of test: participant takes sitting position, barefeet, with heels touching line AB. Distance between heels is 20-30 cm. Feet are vertical in respect to the floor. Hands are placed on the floor between knees with palms down.

His partner holds legs at knees' level to avoid bending in knees. By command "go" the participant smoothly bends forward. Position of maximal bent shall be kept for 2 seconds, fixing fingers on marking.

Results: mark on perpendicular line, which the participant touched with fingers, is registered (with accuracy up to 1 cm).

Test 11, shuttle run 4×10 m, for coordination abilities.

Equipment: stop-watch, fixing time up to one/tenth of second. Even track of 10 meters length, limited by two parallel lines. After every line there shall be two semi-circumferences of 50 cm radius and with center on the line and two wooden cubes of 5×5×5 cm size. Registration table, chair.

Description of the test: by command "to mark", participant takes position of standing start. By command "go" he runs as quick as possible 10 meters to other line, takes one of two cubes, which are in semi-circumference; returns back (also as quick as possible) and puts it in semi-circumference at start (to throw the cube is prohibited). Then he repeats this action with other cube.

Result: the time, fixed with accuracy up to 0.1 sec.: from the moment of start to the moment of second cube putting in semi-circumference.

Test 12: rising in sitting position from lying position (during one minute).

Equipment: stop-watch, mat.

Description of experiment: participant lies on mat, on back, distance between feet shall be about 30 cm. Legs are bent in knees under straight angle, hands' fingers are connected behind head. His partner stands on knees near participant's legs and holds his feet for them not to loose contact with mat. By command "go" participant moves in sitting position, touching knees with elbows and returns in initial position. This exercise shall be repeated during one minute with maximal frequency.

Results: quantity of raisings during 60 seconds.

Test 13 – torso raising from lying position during one minute.

Equipment: gymnastic mats, stop-watch, registration table, chair.

Description of tests: exercise shall be fulfilled on gymnastic mats. Participant lies on mat on abdomen; distance between feet shall be about 10 cm, fingers are connected behind head, legs shall be straight in knees. His partner holds the participant's feet. By command "go", participant arches backward-upward during 60 seconds with maximal frequency.

Result: quantity of raising during 60 seconds.

Statistical analysis: materials of the research were processed in program of statistical anlysis IBM SPSS 20. Factorial analysis as well as discriminant were fulfilled. In factorial analysis we used the model of principle components: Varimax with Kaiser's normalization. For every variable the following values were calculated: mean values, standard deviations, t-test criterion for independent samples.

In discriminant analysis we formed prognostic model of belonging to group. This model builds discriminant function (or if the quantity of groups is more than two – a set of discriminant functions) in the form

of linear combination of variables-predictors that ensures the best groups' division. These functions are built by a set of observations, for which their belonging to groups is known. Further, these functions can be used for new observations with known values of variables-predictors and unknown belonging to group.

For every variable we calculated the following: mean values, standard deviations, single - factorial dispersion analysis for every variable (Box's M test, in-group correlation matrix, in-group covariance matrix, co-variance matrixes for separate groups, general covariance matrix). For every canonic discriminant function we calculated: eigenvalue, dispersion percentage, canonic correlation, Wilks' Lambda, Chi-square. For every step we calculated: priory probabilities, Fisher function's coefficients, non-standardized coefficients of function, Wilks' Lambda for every canonic function.

Results

In table 1 results of motor fitness testing of 14-15 years' age boys are given. 15 years' boys statistically confidently differ from 14 years' age boys by body mass and body length ($p<0.05$). They had bigger mass and height. 15 years' boys showed better results in tests: №4 "Right hand strength, kg", № 5 "Left hand strength, kg", № 11 "Shuttle run 4x9 m, sec." ($p<0.05$). 14 years' age boys were better in tests: № 3 "Keeping angle on parallel bars, sec." № 6 "Pressing ups in lying position, quantity of times" ($p<0.05$). By results of other tests the difference between 15 and 14 years' age boys was not confident statistically ($p>0.05$).

For determination of the tests' in-group informative potential for 14 years' boys we fulfilled factorial analysis by 13 indicators (see table 2). In this analysis we marked out four factors, which explain 67.819 % of indicators' general dispersion.

Factor 1 – is the most informative (23.678%) and correlates with physical condition indicators (named physical condition).

Factor 2 with information potential 21.121% and the highest correlation with relative strength. The factor was named "power fitness".

Factor 3 (13.623%) has the highest correlation with test "Torso forward bending from sitting position, cm". The factor was named "flexibility".

Factor 4 (9.397%) has the highest correlation with indicator of speed-power endurance and was named "speed-power fitness".

Analysis of populations showed that for control of motor fitness physical condition indicators were the most informative.

For determination of tests' in-group information potential we fulfilled factorial analysis by 13 indicators (see table 3) and marked out five factors, which explain 71.372% of total dispersion.

Factor 1 has information potential 21.767%. It correlates with physical condition indicators and was named "physical condition".

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

Test №	Description of test	14 years' age (n=44)		15 years' age (n=68)		t	p
		X	m	X	m		
1.	Body mass, kg	53,77	1,436	62,824	1,337	4,615	<0,05
2.	Body length in standing position, cm	170,64	1,08	177,29	1,04	4,265	<0,05
3.	Keeping of angle on parallel bars, sec.	5,4	,61	1,5	,18	7,224	<0,05
4.	Right hand strength, kg	25,432	1,061	35,338	1,096	6,160	<0,05
5.	Left hand strength, kg	25,318	1,219	31,853	,967	4,210	<0,05
6.	Pressing ups in lying position, quantity of times	24,40	2,11	18,94	,92	2,674	<0,05
7.	Chin ups , quantity of times	5,43	,66	6,04	,51	,734	>0,05
8.	Long jump from the spot, cm	185,11	3,76	186,41	4,18	,216	>0,05
9.	Legs raising up to straight angle in hanging on horizontal bar position, quantity of times	8,50	,91	9,83	,74	1,137	>0,05
10.	Torso forward bending from sitting position, cm	12,14	1,11	13,97	1,06	1,152	>0,05
11.	Shuttle run 4x9 m, sec.	10,27	,08	9,78	,11	3,705	<0,05
12.	Raising from lying position in sitting one during one minute, quantity of times	38,07	1,44	36,41	1,42	,782	>0,05
13.	From lying on abdomen position raising of torso upward during one minute, quantity of times	35,84	2,14	37,25	1,32	-,592	>0,05

Table 2. Factorial analysis matrix for 14 years' boys. Invocation method: Varimax with Kaiser's normalization

Test №	Description of test	Components				Populations
		1	2	3	4	
1.	Body mass, kg	,873				,791
2.	Body length in standing position, cm	,792				,722
3.	Keeping of angle on parallel bars, sec.		,694			,606
4.	Right hand strength, kg	,821				,810
5.	Left hand strength, kg	,803				,753
6.	Pressing ups in lying position, quantity of times		,820			,676
7.	Chin ups , quantity of times		,687			,568
8.	Long jump from the spot, cm	,364	,736			,708
9.	Legs raising up to straight angle in hanging on horizontal bar position, quantity of times		,315	,339	,525	,555
10.	Torso forward bending from sitting position, cm			,859		,846
11.	Shuttle run 4x9 m, sec.		-,466	-,414	,490	,646
12.	Raising from lying position in sitting one during one minute, quantity of times		,300	,741		,705
13.	From lying on abdomen position raising of torso upward during one minute, quantity of times				,634	,430
	Full explained dispersion, %	23,678	21,121	13,623	9,397	67,819

Table 3. Factorial analysis matrix for 15 years' boys. Invocation method: Varimax with Kaiser's normalization

Test №	Description of test	Components					Populations
		1	2	3	4	5	
1.	Body mass, kg	,880					,813
2.	Body length in standing position, cm	,812					,736
3.	Keeping of angle on parallel bars, sec.					,904	,833
4.	Right hand strength, kg	,821					,748
5.	Left hand strength, kg	,710					,720
6.	Pressing ups in lying position, quantity of times		,834				,711
7.	Chin ups, quantity of times		,363			,592	,599
8.	Long jump from the spot, cm		,536		,584		,673
9.	Legs raising up to straight angle in hanging on horizontal bar position, quantity of times				,836		,714
10.	Torso forward bending from sitting position, cm			,836			,812
11.	Shuttle run 4x9 m, sec.	-,341		-,338	-,645		,669
12.	Raising from lying position in sitting one during one minute, quantity of times		,679				,471
13.	From lying on abdomen position raising of torso upward during one minute, quantity of times			,786		-,304	,777
	Full explained dispersion, %	21,767	13,219	12,931	12,638	10,817	71,372

Factor 2 (information potential 13.219% has the highest correlation with relative strength indicators and was named "power fitness".

Factor 3 (12.931%) correlates to the largest extent with test № 10 "Forward torso bending from sitting position, cm" and test № 13 "From lying on abdomen position torso raising upward during 60 seconds, quantity of times". The factor was named "speed-power endurance".

Factor 4 (12.638%) has the highest correlation with relative strength indicators (test № 9 "Legs raising up

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

Test №	Description of test	Coefficients of canonic discriminant function			
		Standardized	Structural	For classification 14 years	15years
				1	2
1.	Body mass, kg	,180	-,405	-1,852	-1,890
2.	Body length in standing position, cm	-,232		5,019	5,083
3.	Keeping of angle on parallel bars, sec.	,858	,635	-,594	-1,267
4.	Right hand strength, kg	-,420	-,541	-,286	-,174
5.	Left hand strength, kg	-,252	-,370	-,310	-,241
6.	Pressing ups in lying position, quantity of times	,117	,235	-,496	-,521
7.	Chin ups , quantity of times	-,262	-,064	,244	,379
8.	Long jump from the spot, cm	,081	-,019	,317	,311
9.	Legs raising up to straight angle in hanging on horizontal bar position, quantity of times	-,178	-,100	,441	,506
10.	Torso forward bending from sitting position, cm	,093	-,101	1,590	1,565
11.	Shuttle run 4x9 m, sec.	,225	,325	33,458	32,817
12.	Raising from lying position in sitting one during one minute, quantity of times	,048	,072	,198	,190
13.	From lying on abdomen position raising of torso upward during one minute, quantity of times	,180	-,052	-581,360	-585,454
	Constant			-1,852	-1,890

to straight angle in hanging on Swedish wall position, quantity of times". The factor was named "power fitness".

Factor 5 (information potential 10.817%) correlates to the highest extent with statistic strength indicators (test № 3 "Keeping angle on parallel bars, sec.".

Analysis of populations showed that for control of motor fitness physical condition and static power endurance indicators are the most informative.

For determination of tests' intra-group information potential we fulfilled discriminant analysis of 14-15 years' age boys' motor fitness testing results. In this analysis we found that results of test № 3 "Keeping of angle on parallel bars, sec." make the greatest contribution in change of function's value (see table 4, standardized coefficients) and have the highest correlation with function (see table 4, structural coefficients). So, the most informative test for determination of age dynamic is static endurnce (test № 3 "Keeping of angle on parallel bars, sec.").

Discussion

In practical application of discriminat analysis results coefficients of canonic discriminant function for classification are used (see table 4).

Analysis of the received results shows that 14 years' boys are better in power fitness (test № 3 "Keeping of angle on parallel bars, sec."), in test №6 "pressing ups in lying position, quantity of times") than 15 years' boys. It points at the fact that in 15 years' age reduction of motor activity and increase of body sizes are the reasons of lagging behind from 14 years' boys. It supplements the data of Mosijchuk (2004), Vedmedenko (2005), Salman (2006) that the reason of low motor functioning level in adolescent age is significant reduction of motor activity together with weak interest in physical culture lessons and negative attitude to physical culture in general.

The received results expand information about special aspects of development of children's and adolescents' motor abilities and about possibility to obtain new information with the help of modeling method (Iermakov, 2010; Adashevskiy et al., 2014; Vlasov et al., 2016).

In the research, for analysis of motor fitness we used discriminant model. Effectiveness of discriminant function in classification of motor and functional fitness was proved in some works [Geoffrey, & Gabie, 1982;, Dorita et al., 2011; Khudolii et al., 2014). Our data also point at prognostic significance of discriminant function in assessment of 14-15 years' age boys' motor fitness.

In researches in the field of physical education and sports multi-dimensional methods and models are used for classification of pupils by their motivation for sports (Milić, Milavić, & Grgantov, 2011), by motor activity (Gert-Jan et al., 2011), for classification of groups into sportsmen and non sportsmen (Lulzim, 2013), for determination of dynamic of 9-12 years' age children's

physical condition under influence of fitness programs (Dorita et al., 2011), for finalizing control of functional and motor fitness of children and adolescents (Geoffrey et al., 1982; Khudolii et al., 2014; Ivashchenko, & Kapkan, 2015). The mentioned authors point at possibility of discriminant analysis application for classification of 5-12 years' age children's motor activity depending on its scope; discriminant function equations permit to classify correctly 93% of grouped data.

The received results supplement the data of different authors (Ivashchenko et al., 2015; Ivashchenko, & Yermakova, 2015; Ivashchenko, Yermakova, Cieslicka, & Muszkieta, 2015; Ivashchenko, Yermakova, Cieslicka, & Zukowska, 2015; Khudolii, Iermakov, & Ananchenko, 2015; Khudolii, Iermakov, Prusik, 2015; Sgro', Quinto, Pignato, & Lipoma, 2016) about demand in structural and functional analysis of children's and adolescents' motor fitness. Our results prove the opinion that discriminant model can be used for pedagogic control of 14-15 years' age boys' fitness level. The received functions can be further used in new observations with known predictor variables and unknown group belonging.

The received results supplement also the data of Ivashchenko and Makarova, (2013), Starchenko (2016), Sribnij (2016) about high informative potential of motor tests in assessment of schoolchildren's fitness.

Conclusions

14 years' boys have better indicators of static and relative strength than 15 years' age boys. It points at the fact that in 15 years' age sharp changes of body mass and height, reduction of motor functioning are the reasons of lagging behind.

The received data show that factorial analysis as well as discriminant are methodological foundation for determination of tests' in-group and intra-group informational potential. For comprehensive control of motor fitness "Keeping of angle on parallel bars" can be recommended.

Conflict of interest

The author declares that there is no conflict of interests.

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ІНФОРМАТИВНІ ПОКАЗНИКИ РУХОВОЇ ПІДГОТОВЛЕНОСТІ ЮНАКІВ 14–15 РОКІВ

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Реферат. Стаття: 10 с., 4 табл., 81 джерел.

Мета дослідження — визначити інформативні показники для групового і міжгрупового контролю рухової підготовленості хлопців 14 і 15 років.

Матеріали і методи: у дослідженні прийняли учать 112 школярів: 44 особи — 14 років, 68 осіб — 15 років, загальноосвітньої школи № 22, м. Краматорськ.

Для вирішення поставлених завдань були застосовані такі методи дослідження: аналіз науково-методичної літератури, педагогічне тестування та методи математичної статистики обробки результатів дослідження. У програму тестування ввійшли загальновідомі тести.

Матеріали дослідження опрацьовані в програмі статистичного аналізу – IBM SPSS 20. Здійснений факторний і дискримінантний аналіз.

Результати дослідження: аналіз спільностей показує, що для контролю рухової підготовленості найбільш інформативними є показники статичної силової витривалості і фізичного розвитку. У процесі аналізу було виявлено, що результати тесту № 3 "Утримання кута в упорі на паралельних брусах, с" мають найбільший вклад в змінну значеннння функції (див. табл. 4, нормовані коефіцієнти) і найбільш вагомий кореляційний зв'язок з функцією (див. табл. 4, структурні коефіцієнти).

Висновки: хлопці 14 років мають кращі показники статичної і відносної сили ніж хлопці 15 років. Це вказує на те, що у 15 річному віці причиною відставання є бурхливі зміни маси тіла і зросту, а також зниженння рухової активності. Отримані дані свідчать, що факторний і дискримінантний аналіз є методологічною основою для визначення внутрішньогрупової і міжгрупової інформативності тестів. Для наскрізного контролю рухової підготовленості може бути рекомендований тест № 3 "Утримання кута в упорі на паралельних брусах, с".

Ключові слова: рухова підготовленість; інформативні тести; факторний; дискримінантний аналіз, хлопці 14 і 15 років.

ИНФОРМАТИВНЫЕ ПОКАЗАТЕЛИ ДВИГАТЕЛЬНОЙ ПОДГОТОВЛЕННОСТИ ЮНОШЕЙ 14–15 ЛЕТ

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Реферат. Статья: 10 с., 4 табл., 81 источников.

Цель исследования – определить информативные показатели для внутригруппового и межгруппового контроля двигательной подготовленности юношей 14 и 15 лет.

Материалы и методы: в исследовании приняли участие 112 школьников: 44 человека – 14 лет, 68 человек – 15 лет, общеобразовательной школы № 22 г. Краматорск.

Для решения поставленных задач были применены следующие методы исследования: анализ научно-методической литературы, педагогическое тестирование и методы математической статистики обработки результатов исследования. В программу тестирования вошли общеизвестные тесты.

Материалы исследования обработаны в программе статистического анализа – IBM SPSS 20. Проведенный факторный и дискриминантный анализ.

Результаты исследования: анализ общностей показывает, что для контроля двигательной подготовленности наиболее информативными являются показатели статической силовой выносливости и физического развития. В процессе анализа было выявлено, что результаты теста № 3 «Удержание угла в упоре на параллельных брусьях, с» имеют

наибольший вклад в изменение значения функции (см. табл. 4, нормированные коэффициенты) и наиболее весомую корреляционную связь с функцией (см . табл. 4, структурные коэффициенты).

Выводы: юноши 14 лет имеют лучшие показатели статической и относительной силы чем ребята 15 лет. Это указывает на то, что в 15 летнем возрасте причиной отставания являются бурные изменения массы тела и роста, а также снижение двигательной активности. Полученные данные свидетельствуют, что факторный и дискриминантный анализ является методологической основой для определения внутригрупповой и межгрупповой информативности тестов. Для сквозного контроля двигательной подготовленности может быть рекомендован тест № 3 «Удержание угла в упоре на параллельных брусьях, с».

Ключевые слова: двигательная подготовленность; информативные тесты; факторный; дискриминантный анализ, ребята 14 и 15 лет.

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