MODELING OF DIFFERENTIATED PHYSICAL FITNESS IN SCHOOL CHILDREN

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Annotation. *Purpose:* to develop a model of physical fitness training for schoolgirls to surrender standard- tives of physical culture (for example, high jump with a running start). Objectives of the study - to determine the relationship between the levels of development of motor skills and results in the high jump with a running start. Also calculate simple regression equation between them. *Material*: The study involved 416 school - prostrate aged 10-17. *Results*: It was found that the greatest influence on the effectiveness of the jump exerts a level of "explosive" force the leg muscles (30,4-47,9 %). The relative influence of mobility power 15,4-23,9 %. The share accounted speed 8,6-15,8 %. Impact indicators flexibility and endurance is 7,6-12,4 % and 4,4-7,2 %. *Conclusions*: The selection of exercises and methods advantageously carried out after comparing models of physical fitness and the actual state of development of motor characteristics. This makes it possible to determine the quantitative information about the shortcomings of physical fitness of each student (group) and specify the direction of future work.
Key words: modeling, physical, fitness, differentiated, approach, schoolgirl.

Introduction

Recent time physical development of children and teen-agers has been being studied from the point of view of age-gender laws. There have been accumulated great experience in age dynamic of morphological and functional characteristics; on the base of it methodic of physical education, corresponding to their age abilities and social demands were worked out [1, 2, 3, 4].

In our researches we found that children of one age and sex are not a homogeneous group: within one age there is rather percentage of children, who differ by temps of physical development, level of biological maturity and motion abilities [5, 6, 7, 8].

That is why methodic of physical education, worked out, basing only age characteristics of “average schoolchild”, turned out to be insufficient. In this connection there appeared idea of differentiated physical education, i.e. methodic, which considered both age and individual abilities of similar by physical condition and fitness groups [9].

In the light of the above said there have appeared demand in further studying of children’s and teen-agers’ morphological functional development in order to work out methods of enhanced and mass express-evaluation of their physical condition, physical fitness; methods of differentiated physical education.

At present these problems have not been studied sufficiently. There is no single opinion about character of interconnection between indicators of physical condition and level of motion abilities [10, 11]. Methodic of physical education for children and teen-agers with physical abnormalities and disorders in physical fitness have also been developed insufficiently [12, 13, 14, 15].

Thus, methodic of physical education of practically healthy children and teen agers (as well as of those, who have disorders of health) shall be adapted to condition of object of influence, i.e. it is necessary to work out it considering individual features of certain school child and single-type by age, sex, level of physical condition and physical fitness groups. Results of research of peculiarities of one age but different physical condition schoolchildren’s motion abilities are additional ground for this. [16]. For example, by the author’s data in age groups of schoolgirls, in average, in 41% of cases there are observed practically statistically significant and confident differences in muscular strength, quickness, endurance and flexibility. It can not but influence on physical workability, quickness of physical exercises’ mastering, temps of preparation to passing tests in physical culture.

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Purpose, tasks of the work, material and methods

The purpose of the work is to work out models of physical fitness, required by schoolchildren for preparation for passing of standard tests in physical culture (on example of running high jump).

The tasks of the research were determination of interconnection between level of motion abilities and results of running high jumps; calculation of equation of pair regression between them.

The methods of the research. Demand in physical training, organized in compliance with individual levels of schoolchildren’s motion abilities requires special approach. For its determination we paid attention to problems of management of physical education’s pedagogical process, which, recent years have been being developed on the base of general principles of cybernetics [17].

One of main conditions of optimal management is presence of quantitative characteristics of models of initial and final states. For passing of definite control exercises it is necessary to have combination of certain levels of different motion characteristics. This can be regarded as model of physical fitness. Comparison of its quantitative

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characteristics with initial data of every pupil will permit to obtain quantitative information about disadvantages of pupils' physical fitness and specify orientation of further work.

Foundation and calculation of digital characteristics of physical fitness's models has been shown on example of the most difficult exercise – running high jump.

The researches involved schoolgirls of main health group, who did not practice sports. Age of the tested was from 10 to 17 years old (52 schoolgirls in every age group).

The choice of such contingent was conditioned by the fact that among them, in contrast to boys, there are more physical fitness indicators of low and below middle level. With it, schoolgirls are more variable than schoolboys in aspect of morphological functional state [18].

For solution of our tasks we determined age peculiarities of interconnection of motion abilities' levels with results of the mentioned exercise and calculated equations of regression for constructing of physical fitness models.

Construction of models was preceded by selection of tests for motion abilities' evaluation, which characterized control exercise: muscular strength ("explosive") was determined by high jump from the spot without waving of arms (as per V.M. Abalakov), active flexibility – by mobility in hip joints (total indicator with bending-unbending of leg), evaluated with the help of goniometer, dexterity – by difference of high jumps from the spot with arms' waving and without it, quickness and endurance – by time of 30, 300 or 500 meters distance's running (depending on age).

These tests were verified for reliability and objectiveness. Correlation coefficients were 0.797-0.938 that corresponded to standard requirements [19].

Age peculiarities of interconnection of motion abilities levels with results of running high jumps were evaluated with partial correlation coefficient. Pair correlation coefficient turned out to be non informative, because it could not permit to accurately discover relations, which were concealed, owing to interaction of motion abilities.

For obvious evaluation of running high jumps results' dependence on motion abilities' level of every tested the obtained data were presented in standard scale. The latter was conditioned by the fact that the studied motion qualities had different units of measurement. They can be comparable is to express every factor (in our case indicator of motion ability) in the form of its own standard deviation. It is the most convenient to do with the help of partial determination coefficient [20].

Results of the research

Analysis resulted in determination that "explosive" power of legs influences to the largest extent on efficiency of 10-17 years old schoolgirls' jump (30.4-47.9%). Relative influence of dexterity on jump's efficiency was 15.4-23.9%. Quickness influences on 8.6-15.8%, flexibility – 7.6-12.4%. And at last, efficiency of running high jump is conditioned by endurance by 4.4-7.2% (from 13 to 17 years old age).

The order of correlation of influences of the studied motion abilities in every age is similar to the above described. The exclusion if 17 years old age, at which quickness and flexibility changed their places. Flexibility influences on jump's result a little bit stronger (11.9%), than quickness (8.6%). Probably it is connected with age features of school girls.

Total data of influence of muscular strength, dexterity, flexibility, quickness and endurance on jump's efficiency are given in table 1.

Coefficients of multiple correlation and determination, presented in table1, witness about strong dependence of running high jump's results on combined influence of the studied motion abilities.

Table 1

Coefficients of multiple correlation ® and determination (R^2) between results of running high jumps and motion abilities' levels of 10-17 years old schoolgirls

Coefficients	Age, years							
	10	11	12	13	14	15	16	17
R	0.875	0.930	0.951	0.983	0.980	0.942	0.893	0.900
R^2	76.5	86.5	90.5	96.6	96.1	88.7	79.7	81.0

High approximation of multiple correlation coefficients to "one" (especially as 13-14 years age) means that for the studied ages of schoolgirls these indicators of motion abilities exhaust to large extent factors, which influence on running high jumps' results. In the given case, as it follows from presented multiple determination coefficients, depending on age, the share of not considered in the research factors is from 3.4 to 23.5%.

On the base of the shown dependences, separately for every age, we composed equations of pair regressions between level of every motion ability and running high jump's result (see table 2).

It should be stressed that equations, given in table 2 were verified by substitution in them of running high jumps' results. Results of verification showed that deviations of actual values from calculated were within limits with one-percent level of significance ($P \leq 0.01$).

Table 2

Regression equations for calculation of physical fitness models for 10-17 years old schoolgirls, required for passing of test – running high jump

Motion abilities	Age, years	Equations	±σ
1	2	3	4
Strength, $X_{пр}$	10	$X_{пр}$=0.66Y-32.4	4.08
	11	$X_{пр}$= 0.43Y-12.5	3.47
	12	$X_{пр}$= 0.49Y-17.6	3.86
	13	$X_{пр}$= 0.50Y-21.6	3.42
1	2	3	4
	14	$X_{пр}$= 0.63Y-37.3	2.66
	15	$X_{пр}$= 0.81Y-56.6	3.29
	16	$X_{пр}$= 0.71Y-456	4.34
	17	$X_{пр}$= .,67Y-42.2	3.35
Quickness, X_{30}	10	X_{30}=8.8-0.3Y	0.26
	11	X_{30}=8.7-0.03Y	0.29
	12	X_{30}=7.9-0.02Y	0.20
	13	X_{30}=7.7-0.02Y	0.27
	14	X_{30}=7.7-0.02Y	0.21
	15	X_{30}=8.8-0.03Y	0.21
	16	X_{30}=8.7-0.03Y	0.27
	17	X_{30}=8.8-0.03Y	0.23
Dexterity, $X_{л}$	10	$X_{л}$=2.4+0.01Y	0.25
	11	$X_{л}$=3.0+0.005Y	0.22
	12	$X_{л}$=3.1+0.004Y	0.32
	13	$X_{л}$=3.1+0.007Y	0.25
	14	$X_{л}$=2.7+0.01Y	0.25
	15	$X_{л}$=1.7+0.02Y	0.31
	16	$X_{л}$=2.4+0.006Y	0.37
	17	$X_{л}$=2.1+0.01Y	0.32
Endurance, X_{300}; X_{500}	13	X_{300}=113.0-0.47Y	7.30
	14	X_{300}=106.5-0.41Y	3.54
	15	X_{300}=102.4-0.36Y	3.07
	16	X_{500}=189.7-0.63Y	6.70
	17	X_{500}=179.4-0.51Y	5.27
Flexibility, $X_{г}$	10	$X_{г}$=62.3+1.08Y	16.85
	11	$X_{г}$=60.2+1.07Y	20.08
	12	$X_{г}$=99.6+0.55Y	13.01
	13	$X_{г}$=86.3+0.63Y	13.32
	14	$X_{г}$=41.9+1.09Y	13.01
	15	$X_{г}$=26.0+1.19Y	16.46
	16	$X_{г}$=89.8+0.59Y	15.25
	17	$X_{г}$=66.1+0.81Y	15.17

Notes: X – indicator of motion ability

Y – result of running high jump; σ – error of equation.

Equations of regression permit to determine how in average value of motion ability will change, if result of running jump increases or reduces by one. With the help of these equations we determined the levels of motion abilities for schoolgirls of 10-17 years old age, which were required for passing standard test of running jump (see table 3).

In order to prove effectiveness of training, oriented on elimination of individual misalignment between initial and model levels of motion abilities, required for passing of standard test in running high jump, we carried out pedagogic experiment. 59 schoolgirls of 14 years old age with different levels of physical condition participated in it. The tested were divided in 4 groups: two experimental and two - control. In each group physical conditions of schoolgirls were equal. Experiment lasted 8 weeks. In total 25 trainings were conducted in the course of experiment; 90 minutes – every training.

Table 3

Models of physical fitness, required for passing standard test in running high jump by schoolgirls of 10-17 years old

Age, years	Strength, cm	Speed, sec.	Dexterity, cm	Flexibility, degrees	Endurance, sec.
10	23.6	6.2	3.3	154.1	-
11	24.1	6.1	3.4	151.2	-
12	31.4	5.9	3.5	154.6	-
13	28.4	5.7	3.8	149.3	66.0
14	28.9	5.6	3.8	156.4	63.4
15	28.5	5.6	3.8	151.0	64.6
16	29.0	5.5	3.0	151.8	123.5
17	28.2	5.7	3.2	151.2	125.8

Notes: digital characteristics of physical fitness were made on the base of results, shown by schoolgirls in offered by us tests.

In experimental groups, depending on which motion abilities were "lagging", we built group organization and orientation of trainings. In the course of experiment, in experimental group the content of physical training was specified depending on dynamic of development of the required motion abilities. For this purpose, one month after beginning of experiment, we repeatedly cleared up degree of misalignment between digital characteristics of gained physical conditions and models.

In control groups trainings were carried out in traditional way. The trainees were complexly trained without consideration of weak places in their physical fitness.

For convenience of general results' determination, with statistical processing of experiment's materials, results of both experimental and both control groups were combined. At the beginning of experiment there were no confident differences between initial data of motion abilities and results of running high jumps of experimental and control groups ($P>0.05$).

As a result of experiment motion abilities of both groups' schoolgirls noticeably improved in comparison with initial. Alongside with it, in experimental group increment was higher than in control one. Values of "explosive" strength and dexterity, which were determined with test "shuttle" run, increased significantly in experimental group, independent on initial level of physical condition. The same indicators of control group schoolgirls had confident increment only for girls with initial level below middle.

Similar advantage of experimental group schoolgirls was registered in mobility of hip joints and in dexterity, which were determined with the help of high jumps from the spot with and without arms' waving. Bu such kind of dexterity confident increment took place in experimental group schoolgirls with middle and below middle initial physical conditions. In control group there was no significant increment of this quality.

As far as positive changes in absolute speed concern they were confident in both groups, but by the value of these changes experimental group's tested with were better independent on their initial physical fitness.

Motion abilities' values of experimental group's schoolgirls were closer to calculated by us models of physical fitness, while at control group they were significantly lagging behind from model characteristics.

The registered difference in motion abilities of experimental and control groups' schoolgirls reflected in results of running high jump (see table 4).

Table 4

Quantity of schoolgirls, who passed standard test "running high jump"

Group	Quantity of tested	Quantity of schoolgirls, who passed standard test
Experimental	29	22 (75.8%)
Control	30	8 (26.6%)

Results of experiment witness that it is purposeful to use differentiated physical training of schoolgirls for passing of normative. This differentiation is conditioned by differences between initial and model levels of motion abilities. Such approach permits to optimize process of physical fitness's monitoring and shortens the period of preparation for passing of standard tests.

Conclusions:

1. For targeted preparation for passing of physical culture standard tests it is necessary to determine initial individual level of motion abilities, which would be required for fulfillment of certain control exercises.
2. It is purposeful to carry out selection of means and methods of trainings basing on results of comparison of developed by us physical fitness models and actual pupils' motion abilities.

It is purposeful to conduct further researches for working out of differentiated physical loads, considering degree of pupils morphological functional development.

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