

Special aspects of motor abilities development in 6-10 years' age girls

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Abstract

Purpose: To find structural model of motor fitness group dynamic in 6-10 years' age girls.

Material: in the research 6 years girls (n=36), 7 years' age girls (n=48), 8 years girls (n=57), 9 years (n=38), and 10 years girls (n=46) participated.

Results: analysis of motor fitness factorial model permitted to obtain information, required for taking decision in management of physical education and working out effective programs of girls' physical training. We found opportunities for receiving metrical estimations of measurements' reliability: stability, concordance and information value of control data for current diagnostic and prognostication of children's physical potentials. In motor fitness factorial models of girls we marked out 6 the most important factors, complied with age: complex development of coordination; quickness, speed power and flexibility; flexibility; strength and motor coordination; coordination and quickness; quickness.

Conclusions: in girls we observed multi-factorial structure of motor fitness. For every age we composed informative tests for motor fitness control.

Keywords: girls, motor abilities, factorial analysis, health, control.

Introduction

The problem of motor activity and health strengthening is rather relevant in Ukraine and in Europe [9, 31]. Health improvement and rising of children's and teenagers' workability depends on optimal motor activity, which is ensured by physical education at school [5, 30].

The main task of school age children's physical education is teaching to motor actions [4, 28, 33]. The training process is regarded from the following positions: organization [7, 23, 30], motivation for motor functioning [10, 35], connection of training efficiency with motor functioning [1, 2], cognitive and motor training [3, 6], influence of motor fitness on training effectiveness [20, 22, 27], influence of physical loads on training effectiveness [16, 24].

One of conditions of schoolchildren's physical education effectiveness is organization of pedagogic control at physical culture lessons [15, 21]. Effectiveness of pedagogic control depends on the presence of object to be controlled and informative value of indicators, which characterize the changes of his/her state [14, 17, 18]. It was found that modeling is an effective method of receiving new information for realization of current and summarizing control on the base of children's and teenagers' testing [13, 19, 26]. Factorial and discriminant analysis is one of methods of statistic modeling. Effectiveness of their application is illustrated by scientific data [12, 25, 34]. The mentioned works witness about demand in searching methodological approaches to solution motor fitness problem and motor fitness control in schoolchildren.

That is why it would be reasonable to analyze special aspects of 6-10 years girls' motor fitness. On the base of motor abilities' factorial structure analysis it is possible to receive new information.

The purpose of the research is to find structural model of motor fitness group dynamic in 6-10 years' age girls.

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Material and methods

Participants: in the research 6 years girls (n=36), 7 years' age girls (n=48), 8 years girls (n=57), 9 years (n=38), and 10 years girls (n=46) participated.

Organization of the research: for solution of our tasks we used the following methods of research: analysis of scientific literature, pedagogic testing and methods of mathematical statistic. Factorial analysis we used as the method of modeling.

In testing program we included commonly known tests [23]. For assessment the girls' motor fitness we registered the results of the following motor tests: static stance on one foot (sec.); walking along segments of hexagon (steps); combined movements of arms, torso and legs (errors); walking along straight line after 5 rotations, deviations (cm); shuttle run 4×9 m (sec.); 30 m run (sec.); frequency of arms' movements (times); catching of falling Dietrich's stick (cm); long jump from the spot (cm); 300 meters' run (sec.); arms' bending and unbending in mixed hanging on rope (times); torso rising in sitting position during 1 minute (times); torso bending from sitting position (cm); index assessment of backbone mobility; index assessment of shoulder joints' mobility.

Statistical analysis: for analyzing the structure of motor abilities level we used factorial analysis – the method of principle factors. The determined factors were processed by Varimax criterion.

Results

The structural model of girls' motor fitness dynamic we fulfilled factorial analysis by 15 indicators of testing.

The analysis permitted to determine five factors, explaining 82.824% of variation dispersion in 6 years' girls.

The first factor (informative value 20.475%) correlates to the largest extent with the following tests' results: №13 "Torso bending from sitting position" (.893), №3 "Combined movements of arms, torso and legs" (.814), №1 "Static stance on one foot" (-.743), №14 "Index

assessment of backbone mobility (bridge)" (.717). This factor characterizes flexibility and motor coordination.

The second factor (informative value 19.493%) has the highest correlation with the following tests' results: № 10 "300 meters' run" (.864), № 2 "Walking along hexagon segments" (.841), № 15 "Index assessment of shoulder joints' mobility" (-.811). This factor characterizes endurance and motor coordination.

The third factor, with informative value of 17.222% correlates to the highest extent with the tests: № 7 "Frequency of arms' movements" (.840), № 9 "Long jump from the spot" (.816), № 5 "Shuttle run 4×9 m" (-.799). The factor was named "Complex development of quickness, speed-power and general coordination".

The fourth factor with informative value of 13.104% has the highest correlation with the tests' results: № 11 "Arms' bending and unbending in mixed hanging on rope" (.908), № 4 "Walking along straight line after 5 rotations, deviations" (-0.896). The factor characterizes power fitness and vestibular stability.

The fifth factor (informative value 12.530%) correlates with test: № 12 "Torso rising in sitting position during 1 minute" (.907) and characterizes power endurance. The factor was named "Power endurance".

Thus, in factorial model of motor fitness the following parameters are marked out: complex development of flexibility and motor coordination (factor 1); endurance and motor coordination (factor 2); quickness, speed-power and general coordination (factor 3); strength and vestibular stability (factor 4) and power endurance (factors 5). Analysis of communities (h2) showed that for assessment of 6 years girls' motor fitness the most informative are tests № 2 "Walking along hexagon segments" (.961), № 4 "Walking along straight line after 5 rotations, deviations" (-0.946), and № 15 "Index assessment of shoulder joints' mobility" (-.931).

In 7 years girls we found six factors, explaining 68.111% of dispersion variants.

First factor (informative value 16.253%) has the greatest correlation with the following tests results: № 9 "Long jump from the spot" (-.786), № 6 "30 meters' run" (.727), № 5 "Shuttle run 4×9 m" (.636). This factor characterizes speed power, quickness and general motor coordination. This factor is complex and takes the place of priority.

Second factor (informative value 12.576%) correlates to the highest extent with the following tests: № 13 "Torso bending from sitting position" (.785), № 10 "300 meters' run" (.685), № 1 "Static stance on one foot (sec.)" (.569). This factor characterizes flexibility, endurance and motor coordination.

Third factor (informative value 11.060%) has the highest correlation with the following: № 4 "Walking along straight line after 5 rotations, deviations" (.806), № 14 "Index assessment of backbone mobility" (.706). The factor was named "Vestibular stability".

Fourth factor (informative value 9.825%) has the highest correlation with the following: № 3 "Combined movements of arms', torso and legs" (-.853), № 8

"Catching of falling Dietrich's stick (cm)" (.682). The factor was named "quickness". It characterizes motor coordination and quickness.

Fifth factor (informative value 9.696%) correlates with results of tests: № 7 "Frequency of arms' movements" (.767), № 2 "Walking along hexagon segments" (.653).

Sixth factor (informative value 8.699%) correlates with tests: № 15 "Index assessment of shoulder joints' mobility" (.860). The factor characterizes flexibility.

Thus, in factorial model of 7 years girls' motor fitness we determined: complex development of motor abilities (factor 1, 2); coordination (factors 3, 4, 5); flexibility (factor 6). Analysis of communities (h2) showed that the most informative for assessment of 7 years girls' motor fitness are: test № 8 "Catching of falling Dietrich's stick (cm)" (.816), test № 3 "Combined movements of arms', torso and legs" (.792), test № 15 "Index assessment of backbone mobility" (.775), test № 13 "Torso bending from sitting position" (.761).

Analysis permitted to determine five factors, explaining 70.665% of dispersion variants, in 8 years girls.

First factor (informative value 18.051%) has the highest correlation with the following tests: № 6 "30 meters' run" (.831), № 5 "Shuttle run 4×9 m" (.806), № 12 "Torso rising in sitting position during 1 minute" (-.698). The factor characterizes quickness, coordination and power endurance.

Second factor (informative value 13.987%) has the highest correlation with tests: № 2 "Walking along hexagon segments" (.829), № 1 "Static stance on one foot" (.817), № 3 "Combined movements of arms' torso and legs" (.713). This factor characterizes development of coordination abilities.

Third factor (informative value 10.491%) correlates with the following tests: № 15 "Index assessment of shoulder joints' mobility" (.686), № 8 "Catching of falling Dietrich's stick" (.683), № 13 "Torso bending from sitting position" (-.647). This factor was named "Flexibility".

Fourth factor (informative value 10.124%) correlates with the following: № 10 "300 meters' run" (.765), test № 14 "Index assessment of backbone mobility (bridge)" (.672). The factor was named "Endurance".

Fifth factor (informative value 9.285%) correlates to the largest extent with the following tests' results: № 4 "Walking along straight line after 5 rotations, deviations" (.761), № 7 "Frequency of arms' movements" (.683). The factor was named "Motor coordination".

Sixth factor (informative value 8.727%) correlates with the following tests: № 11 "Arms' bending and unbending in mixed hanging on rope" (.847). The factor was named "Power endurance".

Thus, in factorial model of 8 years girls' motor fitness we determined: complex development of quickness, coordination and power endurance (factor 1); coordination abilities (factors 2, 5); flexibility (factor 3); endurance (factor 4); strength (factor 6). Analysis of communities (h2) showed that for assessment of 8 years girls' motor fitness the most informative are: test 11 "Arms' bending

and unbending in mixed hanging on rope" (.858), test № 8 "Catching of falling Dietrich's stick" (.818), test № 1 "Static posture on one foot" (.754).

In 9 years girls analysis resulted in five factors, which explain 64.657% of dispersion variants.

First factor (informative value 16.610%) has the highest correlation with the following tests results: № 9 "Long jump from the spot" (.776), № 11 "Arms' bending and unbending in mixed hanging on rope" (.776), № 13 "Torso bending from sitting position" (.739). This factor characterizes strength and flexibility.

Second factor (informative value 13.762%) has the highest correlation with the following; № 3 "Combined movements of arms, torso and legs" (-.694), № 6 "30 meters' run" (.633). The factor characterizes motor coordination and quickness.

Third factor (informative value 12.926%) correlates to the greatest extent with the following tests: № 15 "Index assessment of shoulder joints' mobility" (.747), № 4 "Walking along straight line after 5 rotations, deviations" (.701). The factor characterizes flexibility and motor coordination.

Forth factor (informative value 11.699%) correlates with results of tests: № 2 "Walking along hexagon segments" (.848), № 5 "Shuttle run 4x9 m" (.661). This factor was named "Motor coordination".

Fifth factor (informative value 9.660%) correlates with № 1 "Static stance on one foot" (-.904) and characterizes coordination. The factor was named "Coordination".

Thus, factorial model of 9 years girls' motor fitness is characterized by the following parameters: strength and flexibility (factor 1); motor coordination and quickness (factor 2); flexibility and motor coordination (factor 3); coordination (factors 4, 5). Analysis of communities (h2) showed that for 9 yrs girls' motor fitness the most informative are: test № 1 "Static stance on one foot" (.868), test № 2 "Walking along hexagon segments" (.822) and test № 13 "Torso bending from sitting position" (.840).

Concerning 10 yrs girls, analysis permitted to find five factors, which explain 77.158% of dispersion variants.

First factor (informative value 15.629%) correlates with the following tests: № 3 "Combined movements of arms, torso and legs" (.904), № 2 "Walking along hexagon segments" (.800).

Second factor (informative value 15.016%) correlates with tests: № 6 "30 meters' run" (.871), № 9 "Long jump from the spot" (.569), № 14 "Index assessment of backbone mobility (bridge)" (-.864). The factor characterizes complex development of quickness, speed-power and flexibility.

Third factor (informative value 13.162%) correlates with tests: № 15 "Index assessment of shoulder joints' mobility" (.928), № 13 "Torso bending from sitting position" (-.673) and characterizes flexibility.

Forth factor (informative value 12.200%) correlates with the following: № 11 "Arms' bending and unbending in mixed hanging on rope" (.897), № 1 "Static stance on one foot" (.486). The factor was named "Strength and

coordination fitness".

Fifth factor (informative value 11.821%) correlates with the following results: № 4 "Walking along straight line after 5 rotations, deviations" (-.803), № 7 "Frequency of arms' movements" (.732) and characterizes coordination and quickness.

Sixth factor (informative value 9.329%) correlates with test № 8 "Catching of falling Dietrich's stick" (.842) and characterizes quickness.

Thus, factorial model of 10 years girls' motor fitness is characterized by the following parameters: complex development of coordination abilities (factor 1); quickness, speed-power and flexibility (factor 2); flexibility (factor 3); strength and motor coordination (factor 4); coordination and quickness (factor 5); quickness (factor 6). Analysis of communities (h2) showed that for 9 yrs girls' motor fitness the most informative are: test № 2 "Walking along hexagon segments" (.941), test № 11 "Arms' bending and unbending in mixed hanging on rope" (.894), test № 15 "Index assessment of shoulder joints' mobility" (.892), test № 3 "Combined movements of arm, torso and legs" (.887).

Discussion

The received results supplement the data about factorial and discriminate analysis's application for determination of children's and teenagers' motor fitness structure [8, 11, 29]. In other works high prognostic value of factorial analysis in determination of model and informative indicators of primary school age children was studied [27, 28]. The received data are very important for assessment of primary schoolchildren's readiness for motor actions' training. They supplement the data about development of motor abilities influence on effectiveness of learning [32] and point at demand in strength's training [8, 11].

Our results prove the data of other study [36]. These authors note that such approach permits to obtain metrical results of measurements' reliability: stability, concordance and informative value of control data for current diagnostic and prognostication of children's sport potentials.

In other work discriminat analysis permitted to find informative tests for comprehensive control of primary school boys' motor fitness [24]. It confirms the correctness of the chosen by us direction of research.

The received by us results expand information about special aspects of children's and teenagers' motor abilities' development and about possibility to obtain new information with the help of modeling [21, 35]. The results of our research witness that the received information is required for taking decisions in managing of physical education and for working out of effective physical training programs for 6-10 yrs girls.

Conclusions:

Factorial analysis permitted to form the model of motor fitness and specify informative tests for their pedagogic control in every age group.

In factorial model of girls' motor fitness the highest specific weight is in the following:

6 years – complex development of flexibility and motor coordination (factor 1), endurance and motor coordination (factor 2); quickness, speed-power and general coordination (factor 3); strength and vestibular stability (factor 4); power endurance (factor 5).

7 years – complex development of motor abilities (factors 1, 2); coordination (factors 3, 4, 5), flexibility (factor 6).

8 years – complex development of quickness, coordination and power endurance (factor 1); coordination abilities (factors 2, 5); flexibility (factor 3); endurance (factor 4); strength (factor 6).

9 years – power abilities and flexibility (factor 1); motor coordination and flexibility (factor 2); flexibility and motor coordination (factor 3), coordination (factors 4, 5).

10 years – coordination abilities (factor 1); quickness, speed-power and flexibility (factor 2); flexibility (factor 3); strength and motor coordination (factor 4); coordination and quickness (factor 5); quickness (factor 6).

The most informative tests for assessment of 6-10 yrs girls' motor fitness are:

Test №2 “Walking along hexagon segments” (.961), №4 “Walking along straight line after 5 rotations, deviations” (-0.946), № 15 “Index assessment of shoulder joints' mobility” (-.931) (6 yrs girls);

Test № 8 “Catching of falling Dietrich's stick” (.816), test №3 “Combined movements of arms, torso and legs” (.792), test № 15 “Index assessment of shoulder joints' mobility” (.775), test № 13 “Torso bending from sitting position” (.761) (7 yrs girls);

Test № 11 “Arms' bending and unbending in mixed hanging on rope” (.858), test № 8 “Catching of falling Dietrich's stick” (.818), test № 1 “Static stance on one foot” (.754) (8 yrs girls);

Test № 1 “Static stance on one foot” (.868), test №2 “Walking along hexagon segments” (.822), test № 13 “Torso bending from sitting position” (.840) (9 yrs girls);

Test № 2 “Walking along hexagon segments” (.941), test № 11 “Arms' bending and unbending in mixed hanging on rope” (.894), test № 15 “Index assessment of shoulder joints' mobility” (.892), test № 3 “Combined movements of arms, torso and legs” (.887) (10 yrs. girls).

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Conflict of interests

The author declares that there is no conflict of interests.

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