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

Ivashchenko O.V.
H.S. Skovoroda Kharkiv National Pedagogical University

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.

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

© Ivashchenko O.V., 2017
doi:10.15561/18189172.2017.0302
assessed the 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 forth 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” (-.896). The factor characterizes power fitness and vestibular stability.

The fifth factor (informative value 12.530%) correlates with test: № 12 “Torsos 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 8 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 for assessment of 7 years girls’ motor fitness we determined: complex development of quickness, quickness and general coordination.

Thus, in factorial model of 7 years girls’ motor fitness we determined: complex development of quickness, quickness and general coordination (factor 3); strength and vestibular stability (factor 4). 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” (-.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 “Torsos rising in 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 8.6999%) correlates with tests: № 15 “Index assessment of shoulder joints’ mobility” (.860). The factor characterizes flexibility.

Thus, in factorial model of 8 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 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 “Torsos 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 “Torsos 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), Nº 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 “Torsos 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
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 (factor 3); strength and motor coordination (factor 4); coordination and quickness (factor 5); quickness (factor 6).

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” (.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).

Acknowledgements
The study has been fulfilled in compliance with plan of scientific-research works of Ministry education and science, youth and sports of Ukraine by topic 13.04. “Modeling of children’s and adolescents’ motor abilities’ training and development” (2013–2014) (state registration number 0113U002102).

Conflict of interests
The author declares that there is no conflict of interests.

References
1. Al-Ravashdeh Abdel Baset, Kozina ZhL, Bazilyuk TA, Ilnickaya AS. Influence of motor skills’ training methodic on senior pupils’ speed-power and endurance qualities at light athletic trainings with aplication of interdisciplinary connections. Pedagogics, psychology, medical-biological problems of physical training and sports, 2015; 19(10):3–10. doi:10.15561/18189172.2015.1001

2. Al-Ravashdeh Abdel Baset, Kozina ZL, Bazilyuk TA, Ilnickaya AS. Methodic of senior pupils’ training to throwing movements on the bases of technology of complex impact on motor and intellectual development. Pedagogics, psychology, medical-biological problems of physical training and sports, 2015;19(11), 3–10. doi:10.15561/18189172.2015.1101

3. Altunsoz IH, Goodway JD. Skipping to motor competence: the influence of project successful kinesthetic instruction for preschoolers on motor competence of disadvantaged preschoolers. Physical Education and Sport Pedagogy, 2016;21(4): 366–385. doi:10.1080/17408989.2015.101745

4. Arziutov G, Iermakov S, Bartik P, Nosko M, Cynarski WJ. The use of didactic laws in the teaching of the physical elements involved in judo techniques. Ido Movement for Culture-Journal of Martial Arts Anthropology, 2016;16(4):21–30. doi:10.14589/ido.16.4.4

5. Bodnar I. Integrativne fizične vikhovannia shkolariv riznih medicinich grup [Integrative physical education of different health groups’ schoolchildren]. Lwiv: LSUPC; 2014. (in Ukrainian)

6. Chatzipanteli A, Digelidis N, Karatzoglisis C, Dean R. A tactical-game approach and enhancement of metacognitive behaviour in elementary school students. Physical Education and Sport Pedagogy, 2016;21(2):169–184. doi:10.1080/17408989.2014.931366

7. Chernenko SO. Effectiveness of junior form pupils’ training of gymnastic exercises in different modes of their fulfillment. Pedagogics, psychology, medical-biological problems of physical training and sports, 2015;19(8):65–74. doi:10.15561/18189172.2015.0809

8. Cieslicka M, Ivashchenko O. Features of formation of the cumulative effect of power loads in boys 7 years old. Journal of Education, Health and Sport, 2017;7(1):198–208. doi:10.5281/zenodo.25059

9. Coskun Ali, Sahin Gulsah. Two different strength training and untrained period effects in children. Journal of Physical Education and Sport, 2014;14(1): 42–46.

10. Darnis F, Lafont L. Cooperative learning and dyadic interactions: two modes of knowledge construction in socio-constructivist settings for team-sport teaching. Physical Education and Sport Pedagogy, 2015;20(5):459–473. doi:10.1080/17408989.2013.803528

11. Ivashchenko O, Cieslicka M. Features of evaluations of power loads in boys 7 years old. Journal of Education, Health and Sport, 2017;7(1):175–183. doi:10.5281/zenodo.249184

12. Ivashchenko O, Khudolii O, Iermakov S, Lochbaum MR, Cieslicka M, Zukow W, et al. Intra-group factorial model as the basis of pedagogical control over motor and functional fitness dynamic of 14-16 years old girls. Journal of Physical Education and Sport, 2016;16(4):1190 – 1201

13. Ivashchenko O, Khudolii O, Yermakova T, Iermakov S, Nosko M, Nosko Y. Factorial and discriminant analysis as methodological basis of pedagogic control over motor and functional fitness of 14–16 year old girls. Journal of Physical Education and Sport, 2016;16(2):442 – 451. doi:10.7752/jpes.2016.02068
14. Ivashchenko OV, Ceslika M, Khudolii OM, Iermakov SS. Modeliuvannia silovoi pidgotovljennosti divehotak 6–7 klavsov [Modeling power fitness girls grades 6–7]. Teoria ta metodika fizichnogo vikhovannia, 2014;3:10–16. doi:10.17309/tmfv.2014.3.1103 (in Ukrainian).

15. Ivashchenko OV, Kapkan OO. Informative pedagogic control indicators of 14–15 years age girls’ motor fitness. Pedagogics, psychology, medical-biological problems of physical training and sports, 2016;6:18–25. doi:10.15561/18189172.2016.0063.

16. Ivashchenko OV, Kapkan OO. Simulation of process of 14–15 years old girls’ training of light athletic and gymnastic exercises. Pedagogics, psychology, medical-biological problems of physical training and sports, 2015;19(8):32–39. doi:10.15561/18189172.2015.0805.

17. Ivashchenko OV, Mushketa R, Khudolii OM, Iermakov SS. Kharakteristika silovoi pidgotovljennosti khlopeciv 6–7 klavsov [Characteristic force preparedness boys 6–7 grades]. Teoria ta metodika fizichnogo vikhovannia, 2014;3:17–24. doi:10.17309/tmfv.2014.3.1104 (in Ukrainian).

18. Ivashchenko OV, Pashkevich SA, Krinin Iv. Porivnial’na kharakteristika funktsional’noi, koordinacijnoi i silovoi pidgotovljennosti khlopeciv 8–9 klavsov [Comparative characteristics of functional coordination and force readiness boys 8–9 grades]. Teoria ta metodika fizichnogo vikhovannia, 2014;2:31–39. doi:10.17309/tmfv.2014.2.1099 (in Ukrainian).

19. Ivashchenko OV, Shepelenko GP. Porivnial’na kharakteristika koordinacijnoi i silovoi pidgotovljennosti uchniv serednikh klavsov [Comparative characteristics of Coordination fitness and power of middle class]. Teoria ta metodika fizichnogo vikhovannia, 2014;2:22–30. doi:10.17309/tmfv.2014.2.1096 (in Ukrainian).

20. Ivashchenko OV. Classification of 11-13 yrs girls’ motor fitness, considering level of physical exercises’ mastering. Pedagogics, psychology, medical-biological problems of physical training and sports, 2017; 21(2): 65-70. doi:10.15561/18189172.2017.0203.

21. Ivashchenko OV. Methodic of pedagogic control of 16-17 years’ age girls’ motor fitness. Pedagogics, psychology, medical-biological problems of physical training and sports, 2016;5:26–32. doi:10.15561/18189172.2016.0504.

22. Ivashchenko OV. Kharakteristika silovoi pidgotovljennosti khlopeciv 7–8 klavsov [Features functional coordination force preparedness and girls grades 7–8]. Teoria ta metodika fizichnogo vikhovannia, 2014;2:15–21. doi:10.17309/tmfv.2014.2.1095 (in Ukrainian).

27. Khudolii OM. Teoretiko-methodichni zasadi sistemy pidgotovki ianian kinnostiv 7–13 rokiv. Dokt. Diss. [Theoretical-methodic principles of system of junior, 7-13 yrs. age, gymnasts’ training. Dokt. Diss., Kiev, 2011. (in Ukrainian).

28. Khudolii, OM, Ivashchenko OV, Chernenko SO. Simulation of junior shoolchildren’s training to acrobatic exercises and vaults. Pedagogics, psychology, medical-biological problems of physical training and sports, 2015;19(7):64–71. doi:10.15561/18189172.2015.0709.

29. Kozina Zh. Teoretichni osnovi i rezul’tati praktichnogo zastosuvannia sisternogo analizu v naukovikh doslidzheniakh v oblasti sportivnikh igor [Theoretical principles and results of systemic analysis practical application in scientific researches of sport games]. Teoria ta metodika fizichnogo vikhovannia, 2007; 6:15–18. (in Ukrainian).

30. Krucevich T, Trachuk S, Napadji A. Planuvannia navchal’nogo procesu z fizichnoi kul’turi uchniv serednikh klavsov v zagal’noosvitnikh navchal’nikh zakladakh [Planning of physical culture training process for secondary educational establishments’ pupils]. Teoria i metodika fizichnogo vikhovannia i sportu, 2016;1:36–42. (in Ukrainian).

31. Piccinno Andrea, Colella Dario. Physical fitness level in Italian high-school adolescents: a cross-sectional study. Journal of Physical Education and Sport, 2014;14 (3): 431–437.

32. Repko E, Kozin S, Kostyrko A. Obuchenie dvigatel’nym deistviam detej doshkol’nogo i mladshego shkol’nogo vozrasta na osnove ikh psikhologicheskih i fizicheskikh osobennostej na primere skalolazaniia [Training of pre school age and junior school age children to motor actions on the base of their psychological and physical characteristics on example of rock climbing]. Zdorov’e, sport, reabilitacija, 2016; 2:46–50. (in Ukrainian).

33. Vas’kiv Iv. Innovacijni pidkhodi do organizacii fizichnogo vikhovannia uchniv zagal’noosvitnikh navchal’nikh zakladiv [Innovative approaches to organization of comprehensive educational establishments’ pupils physical education]. Teoria ta metodika fizichnogo vikhovannia, 2015;4:5–12. doi:10.17309/tmfv.2015.4.1174 (in Ukrainian).

34. Vlasov A, Demichkova’ kij A, Ivashchenko O, Lopat’ev A, Pitin M, P’ianilo Ia, Khudolii O. Sistemnij pidkhid i teoretiko-matematichne modeliuvannia biologichnikh ta prirodnikh ob’ektiv i procesiv [Systemic approach and mathematical modeling of biological and natural objects and processes]. Fiziko-matematichne modeliuvannia ta informacijni tehnologii, 2016;23:17–28. (in Ukrainian).

35. Xu X, Ke F. From psychomotor to ‘motorpsycho’: Learning through gestures with body sensory technologies. Educational Technology Research and Development, 2014;62;(6):711–741. doi:10.1007/s11423-014-9351-8.

36. Zaporozhanov VA, Borachinski T. Empiric reliability of diagnostic and prognostic assessments of physical condition of children, practicing spoors. Pedagogics, psychology, medical-biological problems of physical training and sports, 2012;11:38-42.
Information about the author:
Ivashchenko O.V.; http://orcid.org/0000-0002-2708-5636; tmfv@tmfv.com.ua; H.S. Skovoroda Kharkiv National Pedagogical
University; Alchevskiyh str. 29, Kharkov, 61002, Ukraine.

Cite this article as: Ivashchenko OV. Special aspects of motor abilities development in 6-10 years’ age girls. Pedagogics,
psychology, medical-biological problems of physical training and sports, 2017;21(3):105–110. doi:10.15561/18189172.2017.0302

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/index.php/PPS/issue/archive

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution,
and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).

Received: 24.03.2017
Accepted: 10.04.2017; Published: 30.04.2017