

• ТЕОРЕТИКО-МЕТОДИЧНІ, МЕДИКО-БІОЛОГІЧНІ
ТА ПСИХОЛОГІЧНІ АСПЕКТИ ФІЗИЧНОГО ВИХОВАННЯ

• THEORETICAL AND METHODOLOGICAL, MEDICAL, BIOLOGICAL
AND PSYCHOLOGICAL ASPECTS OF PHYSICAL TRAINING

УДК 796.012:1371.711

**DYNAMICS OF DEXTERITY, SPEED,
EXPLOSIVE FORCE AND FLEXIBILITY INDICES
IN SCHOOLCHILDREN BELONGING
TO DIFFERENT MEDICAL GROUPS**

Ivanna BODNAR

Lviv State University of Physical Culture, Lviv, Ukraine

ДИНАМІКА ПОКАЗНИКІВ СПРИТНОСТІ, ШВИДКОСТІ, ВИБУХОВОЇ СИЛИ ТА ГНУЧКОСТІ ШКОЛЯРІВ РІЗНИХ МЕДИЧНИХ ГРУП. Іванна БОДНАР. Львівський державний університет фізичної культури, Львів, Україна

Анотація. Визначення ефективних напрямків фізичної підготовки учнів середнього шкільного віку можливе лише за умови виявлення сенситивних періодів школярів різних медичних груп. Мета дослідження – установити особливості динаміки природного розвитку окремих фізичних якостей школярів середнього шкільного віку різних медичних груп. Проведено тестування 1414 учнів 16-ти загальноосвітніх шкіл України середнього шкільного віку. Визначалися щорічні зростання результатів тестування. Для вивчення гетерохронії в розвитку фізичних якостей використовували методичний підхід, запропонований А.А. Гужаловским, що передбачав з'ясування у скільки разів загальна різниця між 10 і 16 роками більша від різниці між результатами, отриманими в найближчі вікові відрізки. Доведено, що у школярів, які належать до різних медичних груп, спостерігалися відмінності в настанні періодів високих темпів розвитку окремих фізичних якостей та в їхній потужності. У СМГ періоди розвитку спритності, швидкості, вибухової сили та гнучкості були вужчими, темпи зростання суттєво нижчими, ніж в ОМГ. Підтверджено тенденцію до відставання (на 1–2 роки) періодів високих темпів розвитку спритності в дітей із відхиленнями у стані здоров'я.

Ключові слова: школярі, підготовленість, розвиток, здоров'я.

Problem statement. Improvement of schoolchildren physical fitness indices is one of the crucial tasks facing physical education at secondary schools. Reports on the time history of physical fitness indices in accordance with schoolchildren's age will make it possible to define properly favourable periods of physical qualities development and their evolution in students. It is known that the periods of accelerated development of certain physical qualities are claimed to be "susceptible" to pedagogical ascendancy. Major growth of physical fitness indices can be noticed when adequate, properly implemented actions directed towards certain physical properties development in the process of physical education coincide with the periods of the so called "maximum rate of progress". Lower growth is noticed during the periods of submaximal rates of development and during "comparatively high rates of progress", whereas the lowest growth can be observed in the periods of delayed development. Re-testing administered [2] in two years after experimental classes' completion demonstrated effectiveness of the above mentioned "coincidence", since the pupils had not only gained higher indices of physical fitness but managed to retain the achieved advantages for a longer period.

The research connection with scientific topics and plans: the research has been carried out in accordance with the "Substantiation of physical fitness standards for 5-9 form pupils of comprehensive secondary schools" scientific topic for the period from 2012 to 2013. The topic was agreed with the Ministry of Education and Science, Youth and Sport of Ukraine (Order No 1241 of 10.28.2011)

Analysis of the latest investigations and publications. Up-to-date special publications cite a lot of data (at times controversial ones) concerning the age periods characterized by accelerated

paces of development in schoolchildren of different ages and gender. V.A. Yarmolenko [12] for instance indicates the fact of movement coordination deterioration in girls during their puberty period. At the same time the higher the rate of sexual maturation was, the lower were the results. A.V. Vyshniakov [1] claims instead that the majority of coordination abilities' indices do not differ significantly despite puberty stage. Motion flow and sequence indices in girls as well as their capability to reaction in quick movements improved significantly, whereas the results of certain exercises performance took a turn for the worse.

It has been defined that rates and duration of acceleration for each physical quality as well as the dynamics of the qualities natural acceleration differs in children with different constitution types [4, 5, 7, 9, 10].

Different researchers apply various testing exercises meant for physical qualities measurement, although it had been ascertained that sensitive periods for one physical quality acquired by different tests do not necessarily coincide in time. Experts apply different modes and formulae to define the growth rates of physical qualities indices. Liah V.I., for instance, suggests assessing the deviation scope percentage between average values during the period of ten school years compared with annual indices. While interpreting the indices obtained it is advisable to consider that the general disparity between the results at the age of 7 and 17 is registered as 100 percent; high rate of development (sensitive period) is characterized by the growth of results that makes more than 10 percent; average rate fluctuates in the limits of 7.5 and 9.9 percent; low rate is characterized by 5.0 to 7.4 percent; subcritical period displays the growth that is below 0 or fluctuates between 0 and 4.9 percent [6]. A.A. Huzhalovsky suggested that the assessment (presented in arbitrary units) should show how many times average values of advance over a ten-year school period exceed annual growth rates [3]. Meanwhile there is no information concerning any distinctions between the above mentioned periods in schoolchildren belonging to different medical health groups. This information might be of great value for the teachers who conduct joint physical education classes for the schoolchildren belonging to different medical groups. At the same time L.V. Shapkova [11] admits the possibility of chronological discrepancy in accelerated physical qualities growth among the schoolchildren with different level of health. This assertion is supported by the fact that the sensitive periods of physical qualities maturation in children with considerable aberrations from a sound state (with mental retardations in particular) come 2 to 3 years later as compared with their peers. In connection with this the necessity of further study of sensitive periods for secondary schoolchildren belonging to different medical groups seems to be quite obvious. Further investigations are meant to define effective ways and methods of schoolchildren physical training.

The objective of the research is to determine the dynamics of natural growth characteristics of certain physical qualities in secondary school children belonging to different medical groups.

The tasks:

1. To compare the occurrence time and the duration of maximum and high rates of major physical qualities development in secondary school children.
2. To compare the dynamics of physical fitness indices in schoolchildren belonging to different medical groups.

Research methods and management: Method of theoretical cognition (induction, deduction, analysis, synthesis and generalization); pedagogical surveillance; method of mathematical statistics. One thousand four hundred and fourteen secondary school children (761 boy and 653 girls) from sixteen comprehensive secondary schools of Ukraine underwent testing. Among the tested schoolchildren 353 pupils belonged to main medical group (MMG), another 653 children belonged to preparatory medical group (PMG) and 408 pupils came within special medical group (SMG).

Application of the block of 11 tests enabled to achieve versatile assessment of the level of secondary school children's training as well as to compare the tests results of the schoolchildren belonging to different health and age groups. The evolution of changes as the school years went by could also be traced. All the tests fitted with the criteria demanded from standardized tests, possessing rather high coefficient of validity and reliability. To create an additional motivation stimulus for revealing maximum results the testing was administered in the form of competitions among classes for the title of "The strongest class".

To study heterochrony of the development of physical qualities a technical approach suggested by A.A. Huzhalovsky [3] has been applied. The technique allowed to establish the disparity of the results attained in the closest age intervals, that is between 10 and 11 years of age (a_1), 11 and 12 years of age (a_2) and the like; to establish general disparity, that is between 10 and 16 years of age (b); to clarify how many times “ b ” is larger than “ a ” ($c=b/a$). Those age periods, which were considered as those characterized by maximum or very high growth rates of dexterity displayed annual physical qualities growth rates twice as big as the average annual growth rates of the tests results. Periods of submaximum or high growth rates were characterized by the growth of test results within 1.51 and 2 arbitrary units (a.u.). During the periods of comparatively high growth rates this figure was not more than 1.5 times as much. For the periods of low or decelerated development the figure was lower than 1.0 a.u.

The research results and their argumentation. In order to determine the level of *dexterity* 3 test exercises were offered: 1) “*ten figure-of-eights*” *Kopylov test* (starting position – standing position, straddle stand trunk bent forward, knees are not bent!, hands are on the knees level, tennis ball kept in hands. At the command the pupil passes the ball from one hand to another between the legs. Two of such passes make one figure-of-eight movement. A pupil has to perform 10 figure-of-eights for the shortest time possible. If the ball falls during the exercise execution the pupil has to pick it up and continue with the task, at the same time stopwatch was not stopped. Two attempts were allowed and the best result was fixed); 2) *gripping and hitting a volleyball* with both hands against the wall during 30 sec. Distance from the wall made 2 metres. It was forbidden to return a ball using hands: only gripping and throwing were allowed. Two attempts were executed with a 2 min. interval whereupon the best result was taken into account. To obtain an integrated assessment of various forms of dexterity manifestation it was recommended to draw “a target” on the wall measuring 1x1 metres, its centre being located at the pupil’s eyes level (distance from the floor to the lower edge of the target made 1 metre). Inaccurate hits were not taken into account; 3) *modified Romberg’s test* (standing position, feet are on one line so that the toes of the right foot touch the heel of the left foot, hands down, - a pupil should keep this position. If he/she succeeds to keep his/her balance for 15 sec. he/she gets “2” points (“1” point is given in case the pupil fails); raising arms forward and keeping the balance for another 15 sec. means the pupil is marked with “3” points; if the pupil closes his eyes and keeps the balance for 15 sec. more he/she is marked with “4”; keeping balance with the head raised and the eyes closed for additional 15 sec. brings the pupil “5” points).

While processing the dynamics of the dexterity indices obtained in two exercises (ten figure-of-eights and volleyball throwing and gripping – fig. 1) certain conformities could be noticed in every medical group. Thus the MMG schoolchildren having performed both exercises displayed improvement of dexterity up to 13 years of age but afterwards the results worsened. The most favourable period (that of maximum and submaximal rates of dexterity development) for the PMG pupils fell on 11 to 13 years of age. Period of accelerated development rates in SMG pupils could be observed at the age of 13 to 16. In the upshot the decrease of health level gradually shifted the rates of dexterity accelerated development till the end of the secondary school-going age period. Thus the analysis of dexterity growth incremental rates alongside with age evolution has testified to the fact that these indices are different for the schoolchildren belonging to different medical groups (table 1). This conclusion brings forward the necessity of differentiated approach while elaborating curricula for schoolchildren belonging to different medical groups.

At large the dynamics of speed qualities’ changes in *ten extensions of arms in upperarm support from a horizontal bar* (fig.2) in schoolchildren of different medical groups and both sexes at the age of 10 to 16 demonstrated relative stability. The age of 11-12 years merely might be considered as a period moderately sensitive to development of arms extensors speed in school-goers of middle age (see table 1), whereas SMG girls displayed 7.00 percent ($p<0,01$) growth rates; the MMG and PMG girls showed relatively highest results growth in this exercise, while SMG boys’ indices didn’t exceed 3 percent (fluctuating within 1.94 to 2.67 percent).

While comparing the time indices of *the explosive force* accelerated development in secondary school-goers (fig.3) it has been testified that those time indices for schoolchildren with health prob-

lems (SMG) are concentrated within 11 to 13 years of age period, whereas for their practically fit school peers (MMG children) the periods with valid improvement of the results alternate with the periods of opposite dynamics trends.

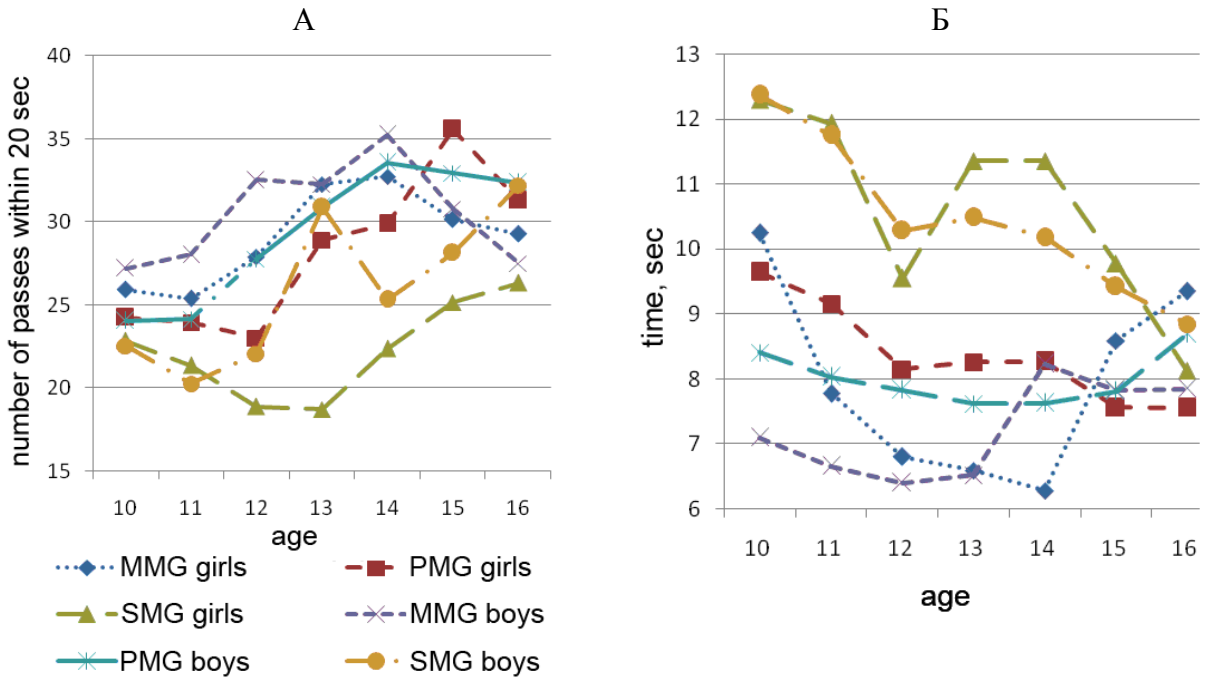


Fig.1. Dynamics of the exercises for dexterity results achieved by schoolchildren belonging to different medical groups:

A – number of passes and gripping of volleyball near the wall within 30 sec;
 B – “ten figure-of-eights” Kopylov test

Table 1

Periods of accelerated development of physical qualities for schoolchildren belonging to different medical groups

Physical qualities	Exercises	Years of age	Girls			Boys		
			MMG	PMG	SMG	MMG	PMG	SMG
1	2	3	4	5	6	7	8	9
Dexterity	Kopylov Test 10 "8"	10-11						
		11-12						
		12-13						
		13-14						
		14-15						
		15-16						
	Throws and grips of a ball with both hands from the wall within 30', times	10-11						
		11-12						
		12-13						
		13-14						
		14-15						
		15-16						
Speed	Ten bandings and extensions of arms in upperarm support on a horizontal bar, sec.	10-11						
		11-12						
		12-13						
		13-14						
		14-15						
		15-16						

Continuation of table 1

1	2	3	4	5	6	7	8	9
Explosive force	Long standing jump, cm	10-11						
		11-12						
		12-13						
		13-14						
		14-15						
		15-16						
Flexibility	Side bender, mm	10-11						
		11-12						
		12-13						
		13-14						
		14-15						
		15-16						

Notation conventions:

- maximum (very high) motion skills growth rates;
- submaximal (high) growth rates;
- moderately high growth rates.

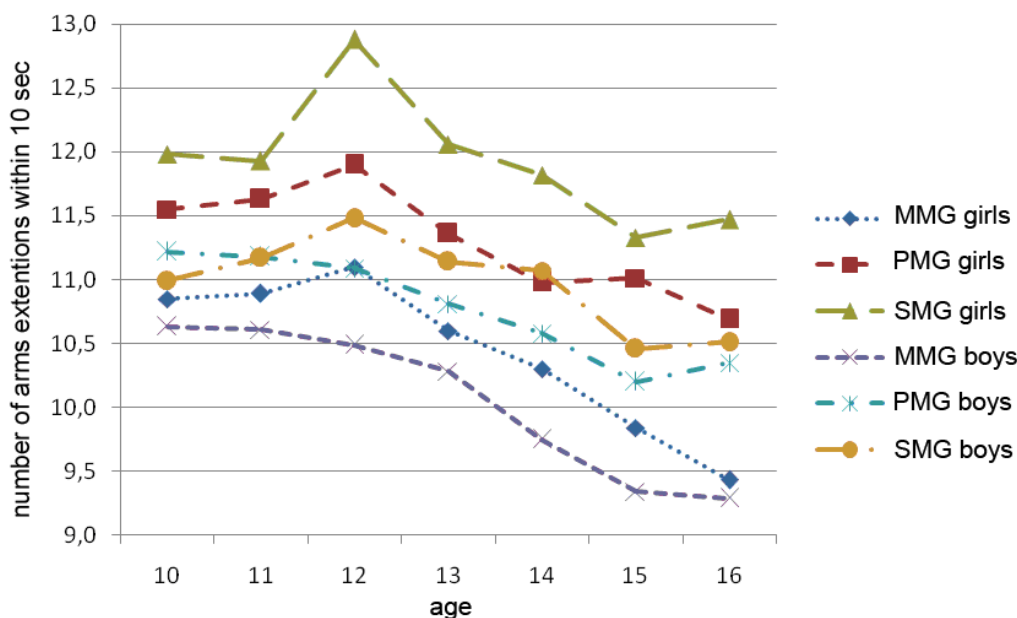


Fig.2. Dynamics of the results of speed exercises execution by schoolchildren belonging to different medical groups

Analysis of the age dynamics of the explosive force growth rates' relative values (see table 1) testified to the fact that MMG children showed more intensive and more prolonged indices as compared to PMG and SMG pupils.

Flexibility has been defined by means of average values calculation of two side benders (to the right and to the left). Standing position, palms pressed to one's hips, the point of terminal phalanx end of the middle finger is marked on the hip with a chalk. A pupil was performing bend to the right lingering for 2 to 3 sec. to retain the position while the second mark was made. Then the distance between the two marks was measured (to 1 mm). In order to avoid bending forward the exercise was conducted near the wall and the teacher watched closely that the pupil does not deflect his/her shoulders from the wall.

Relatively highest (fig.4) and at the same time average by quantity were the results growth rates of the 13 to 16 years old children, id est of the eldest age groups of the secondary school pupils:

15-16 years old MMG girls (4.53 percent), PMG 13-14 (3.80 percent), SMG 14-15 (21.69 percent, $p < 0,01$): MMG boys of 14-16 years of age (15.92 percent and 8.58 percent, accordingly $p < 0,01$), PMG 15-16 years old (8.72 percent), SMG 14-15 years old (15.42 percent, $p = 0,07$). High growth rates of flexibility indices in 13 to 16 years old children could be accounted for the strengthening of corresponding muscle groups. Generalization of the results has shown that duration of the accelerated flexibility growth periods in SMG schoolchildren was smaller as compared to that of MMG children. The exercise mentioned also confirmed the tendency to time-lagging of the physical qualities accelerated development alongside with the decrease of the school-goers level of health (see table 1).

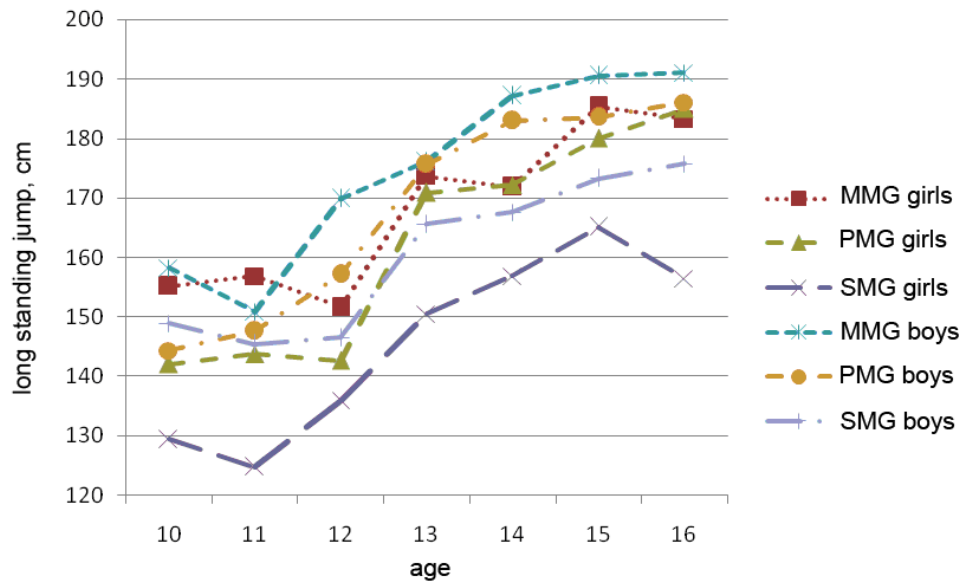


Fig.3. Dynamics of the results of explosive force exercises execution by schoolchildren belonging to different medical groups

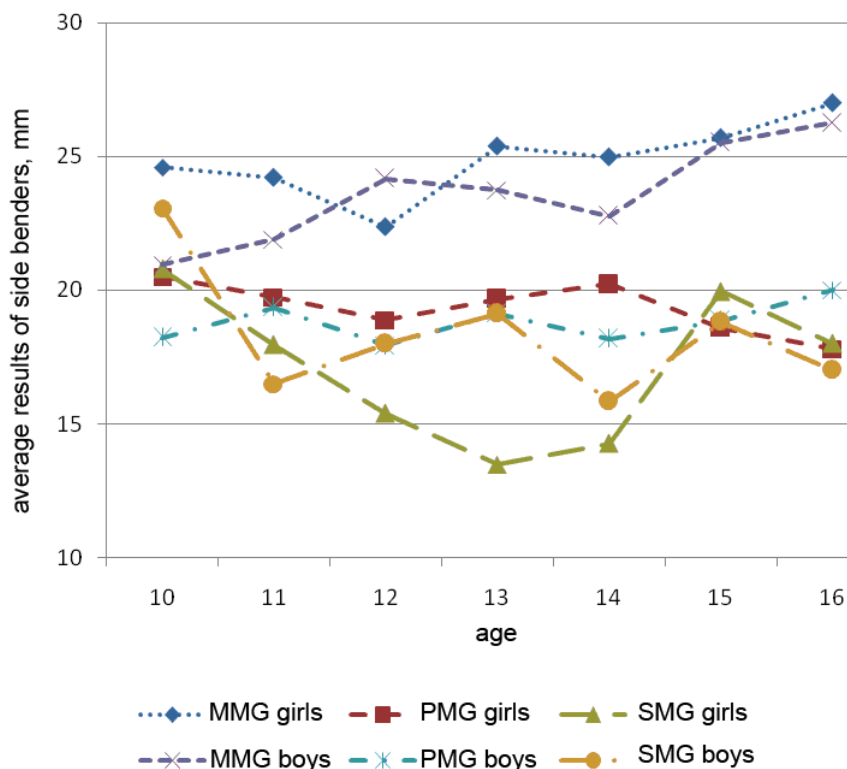


Fig.4. Dynamics of the results of flexibility exercises execution by schoolchildren belonging to different medical groups

On the whole the largest number of periods with physical qualities' high rates of growth was peculiar to 11 to 13 years old age group, which is most likely caused by puberty age approach. As is generally known the beginning of puberty period is accompanied with a powerful hormone emission, which affects strongly the activities of all functional systems.

It is quite evident that the data obtained coincide partially with those presented in special publications. Nevertheless our results partially differ from the existing ones concerning the periods' duration of rapid physical qualities development in schoolchildren. The phenomenon could be explained by different experimental setting, first and foremost by the exercise modes applied. It might be conceded that "the division" of all the schoolchildren into groups depending upon their level of health (medical groups) also causes the data discrepancies. Specificity of the age period chosen for investigations (puberty period, characterized by intensification of heterochrony and disharmony of the body organs and systems at morphological and functional levels) as well as probably more early start of puberty period in contemporary schoolchildren might also explain the discrepancies in the research results. Another reason for such disagreement could be hidden in the fact that A. A. Huzhalovsky's method developed and employed in terms of 10-years school education might "not work" for the reduced age period of children (from 10 to 16 years of age). The above mentioned characteristics substantiate the necessity for further research of the problem.

The major conclusion drawn from the research results seems to reside in the existence of the discrepancy between the duration time (beginning) and the completion time of maximum rates periods of physical qualities development in the schoolchildren belonging to different medical groups. It might be advisable to carry on similar research involving not only secondary school pupils but school-goers of all age groups.

Conclusions.

1. It has been found that the largest number of periods with high rates of physical qualities development occurred at the age of 11 to 13, which might be attributed to the beginning of rapid puberty period. The obtained data partially coincide though partially differ from the prevailing ones concerning the beginning and the duration of maximum and high rates of physical qualities development periods. This fact depicts dialectical complexity of the phenomenon of different stages' alternation in the life of an individual and might be attributed to the lack of information in this sphere.

2. It has ascertained that the schoolchildren belonging to different medical groups displayed heterochrony in the periods of high rates of certain physical qualities development as well as the difference in their powerfulness. Periods of accelerated physical qualities development in SMG schoolchildren were narrower and physical qualities development rates were considerably lower as compared with those of MMG children. The sensitive period for certain physical qualities effective development, dexterity and flexibility in particular, shifted gradually for 1 to 2 years till the end of the secondary school age as a result of health level descend. Hereby the tendency to periods' lag of physical qualities high rates of development in children with health abnormalities has been corroborated.

Список літератури

1. Вишняков А. В. Показатели развития координационных способностей у девочек 11–12 лет в зависимости от степени полового созревания / А. В. Вишняков // Новые исследования в психологии и возрастной физиологии. – 1991. – № 2. – С. 92–95.
2. Гужаловский А. А. Развитие двигательных качеств у школьников / А. А. Гужаловский. – Минск : Народная асвета, 1978. – 88 с.
3. Гужаловский А. А. Этапность развития физических (двигательных) качеств и проблема оптимизации физической подготовки детей школьного возраста : автореф. дис. ... д-ра пед. наук / А. А. Гужаловский. – М., 1979. – 23 с.
4. Левушкин С. П. Сенситивные периоды в развитии физических качеств школьников 7–17 лет с разными типами телосложения [Электронный ресурс] / С. П. Левушкин // Физическая культура: воспитание, образование, тренировка. – 2006. – № 6. – С. 2–5. Режим доступа: <http://bmsi.ru/doc/b6865b52-a72f-4dc3-921e-e8ca3263a28b> (Дата обращения: 10.11.13.)
5. Левушкин С. П. Физиологическое обоснование физической подготовки школьни-

ков 7–17 лет с разными типами телосложения : автореф. дис. ... д-ра биол. наук. / С. П. Левушкин. – М., 2005. – 30 с.

6. *Лях В. И.* Сенситивные периоды развития координационных способностей детей в школьном возрасте / Лях В. И. // Теория и практика физической культуры. – 1990. – № 3. – С. 15–18.

7. *Мукина Е. Ю.* Развитие двигательных координационных способностей у младших школьников специальных медицинских групп : автореф. дисс. ... канд. пед. наук. / Е. Ю. Мукина. – Тамбов, 2007. – 20 с.

8. *Никитюк Б. А.* К вопросу о сенситивных, критических и кризисных периодах [Электронный ресурс] / Никитюк Б. А., Черкасова Р. С. // Практическая психология и логопедия. – 2008. – № 2. – С. 21–30. – Режим доступа: <http://www.follow.ru/article/345>. (Дата обращения 10.11.2013).

9. *Писаренкова Е. П.* Развитие специфических координационных способностей у школьников 7–15 лет разных типов конституции : автореф. дис. ... канд. пед. наук. / Е. П. Писаренкова. – Смоленск, 2010. – 18 с.

10. *Феоктистов М. Ф.* Технология развития физических способностей подростков на основе учета сенситивных периодов : автореф. ... канд. пед. наук. / М. Ф. Феоктистов. – Волгоград, 2010. – 24 с.

11. *Шапкова Л. В.* Средства адаптивной физической культуры : методические рекомендации по физкультурно-оздоровительным и развивающим занятиям детей с отклонениями в интеллектуальном развитии / Л. В. Шапкова; под ред. С. П. Евсеева. – М. : Сов. спорт, 2001. – 464 с.

12. *Ярмоленко В. А.* Возрастные особенности координации движений у девочек 11–14 лет / В. А. Ярмоленко // Новые исследования по возрастной физиологии. – 1984. – № 2. – С. 69–71.

ДИНАМИКА ПОКАЗАТЕЛЕЙ ЛОВКОСТИ, СКОРОСТИ, ВЗРЫВНОЙ СИЛЫ И ГИБКОСТИ ШКОЛЬНИКОВ РАЗНЫХ МЕДИЦИНСКИХ ГРУПП

Иванна БОДНАР

*Львовский государственный университет
физической культуры, Львов, Украина*

Аннотация. Определение эффективных направлений физической подготовки учащихся среднего школьного возраста возможно лишь при условии выявления сенситивных периодов школьников разных медицинских групп. Цель исследования – установить особенности динамики естественного развития отдельных физических качеств школьников среднего школьного возраста различных медицинских групп. Проведено тестирование 1414 учащихся 16-ти общеобразовательных школ Украины среднего школьного возраста. Определялись ежегодные приросты результатов тестирования. Для изучения гетерохронии в развитии физических качеств использовали методический подход, предложенный А.А. Гужаловским, предусматривавший выяснения во сколько раз общая разница между 10 и 16 годами больше от разницы между результатами, полученными в ближайшие возрастные отрезки. Доказано, что у школьников, принадлежащих к разным медицинским группам, наблюдались различия в наступлении периодов высоких темпов развития отдельных физических качеств и их мощности. В специальных медицинских группах периоды развития ловкости, скорости, взрывной силы и гибкости были уже, темпы роста существенно ниже, чем в основной медицинской группе. Подт-

верждено тенденцию к отставанию (на 1–2 года) периодов высоких темпов развития ловкости у детей с отклонениями в состоянии здоровья.

Ключевые слова: школьники, подготовленность, развитие, здоровья.

**DYNAMICS OF DEXTERITY, SPEED,
EXPLOSIVE FORCE AND FLEXIBILITY INDICES
IN SCHOOLCHILDREN BELONGING
TO DIFFERENT MEDICAL GROUPS**

Ivanna BODNAR

Lviv State University of Physical Culture, Lviv, Ukraine

Abstract. Revealing of sensitive periods in schoolchildren of various medical groups enhances the possibility of defining effective ways of physical conditioning of secondary school children. The objective of the research is to determine characteristics of natural growth and development indices of certain physical qualities in secondary school children belonging to different medical groups. One thousand four hundred and fourteen secondary school children from sixteen comprehensive secondary schools of Ukraine underwent testing. Annual increase of the tests' results has been defined. For the purpose of studying heterochrony of physical qualities a methodological approach suggested by A. A. Huzhalovsky was applied, which made it possible to clarify the correlation between 10 and 16 years of age general disparity as compared to the results' disparity gained during closer age periods. It has been proved that the schoolchildren belonging to different medical groups show distinctive periods in reaching high rate of the development of certain physical qualities as well as their intensity. In special medical group (SMG) schoolchildren the periods of dexterity, speed and explosive force development were narrower, rates of growth were considerably lower as compared to main medical group (MMG). A tendency towards lagging (for 1 to 2 years) of the periods of high rates of dexterity development in schoolchildren with health abnormalities has been confirmed.

Key words: schoolchildren, physical fitness, development, health.

References

1. *Vishnjakov A. V.* Pokazateli razvitija koordinacionnyh sposobnostej u devocek 11–12 let v zavisimosti ot stepeni polovogo sozrevanija [Indicators of coordination abilities in girls 11–12 years, depending on the degree of sexual maturation] // *Novye issledovanija v psihologii i vozrastnoj fiziologii.* – 1991. – № 2. – s.92–95. (*Rus.*)
2. *Huzhalovskij A. A.* Razvitie dvigatel'nyh kachestv u shkol'nikov [The development of motor qualities in students]. – Minsk: Narodnaja asveta, 1978. — 88 s. (*Rus.*)
3. *Huzhalovskij A. A.* Jetapnost' razvitija fizicheskikh (dvigatel'nyh) kachestv i problema optimizacii fizicheskoj podgotovki detej shkol'nogo vozrasta [Stages of development of physical (motor) skills and the problem of optimizing physical training of school children] : avtoref. dokt. dis. – M., 1979. – 23 s. (*Rus.*)
4. *Levushkin S. P.* Sensitivnye periody v razvitii fizicheskikh kachestv shkol'nikov 7–17 let s raznymi tipami teloslozhenija [Sensitive periods in the development of physical qualities of pupils 7–17 years with different body types] // *Fizicheskaja kul'tura: vospitanie, obrazovanie, trenirovka.* – № 6, 2006. – S. 2-5. Rezhim dostupa: <http://bmsi.ru/doc/b6865b52-a72f-4dc3-921e-e8ca3263a28b> Data obrashhenija: 10.11.13. (*Rus.*)
5. *Levushkin S. P.* Fiziologicheskoe obosnovanie fizicheskoj podgotovki shkol'nikov 7–17

let s raznymi tipami teloslozhenija [Physiological basis of physical training of school children 7–17 years with different body types] : avtoref. dis. ... d-ra biol. nauk. – Moskva, 2005. – 30 s. (Rus.)

6. *Liah V. I.* Sensitivnye periody razvitija koordinacyonnyh sposobnostej detej v shkol'nom vozraste [Sensitive periods of development of coordination abilities of children of school age] // Teorija i praktika fiz. kul'tury. – 1990. – № 3. – S. 15–18. (Rus.)

7. *Mukina E. Ju.* Razvitie dvigatel'nyh koordinacionnyh sposobnostej u mladshih shkol'nikov special'nyh medicinskih grupp [Development of motor coordination abilities in primary school children of special medical groups] : avtoref. diss. ... kand. ped. nauk. – Tambov, 2007. – 20 s. (Rus.)

8. *Nikitjuk B. A., Cherkasova R. S.* K voprosu o sensitivnyh, kriticheskikh i krizisnyh periodah [On the sensitive, critical and crisis periods] // Prakticheskaja psihologija i logopedija. – 2008. – № 2. – S. 21–30. Rezhim dostupa: <http://www.follow.ru/article/345>. Data obrashchenija 10.11.2013. (Rus.)

9. *Pisarenkova E. P.* Razvitie specificheskikh koordinacionnyh sposobnostej u shkol'nikov 7–15 let raznyh tipov konstitucii [The development of specific coordination abilities in schoolchildren 7–15 years for various types of constitution] : avtoref. diss. ... kand. ped. nauk. – Smolensk, 2010. – 18 s. (Rus.)

10. *Feoktistov M. F.* Tehnologija razvitija fizicheskikh sposobnostej podrostkov na osnove ucheta sensitivnyh periodov [Technology development of physical abilities of teenagers on the basis of accounting sensitive periods] : avtoref. k. ped nauk. – Volgograd, 2010. – 24 s. (Rus.)

11. *Shapkova L. V.* Sredstva adaptivnoj fizicheskoj kul'tury [Means of adaptive physical education] : metodicheskie rekomendacii po fizkul'turno-ozdorovitel'nyh i razvivajushhim zanjatijam detej s otklonenijami v intellektual'nom razvitii / Pod red. S. P. Evseeva. – M. : Sov. sport, 2001. – 464 s. (Rus.)

12. *Jarmolenko V. A.* Vozrastnye osobennosti koordinacii dvizhenij u devocek 11–14 let [Age features of coordination among girls 11–14 years] // Novye issledovanija po vozrastnoj fiziologii. 1984. – № 2. – s. 69–71. (Rus.)

Стаття надійшла до редколегії 28.11.2013