STATISTICAL INTERCONNECTIONS BETWEEN THE INCREMENT OF 7–8-YEAR-OLD BOYS' PHYSICAL QUALITIES OF DIFFERENT SOMATOTYPES

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Abstract. The level of physical development, health, preparation as a criterion for the implementation of a differentiated, individual approach to students in the process of physical education is determined by the current program. However, these criteria are marked by lability, that is, the change in the characteristics under the influence of various external factors, and therefore only partially reflect the individual characteristics of adolescents. On the other hand, indicators are displayed that reflect the different aspects of human life and for a long time remain unchanged – genetic markers, one of which is the somatic type of constitution. Improvement of the physical qualities of boys during 7–8 years became the object of our study. The basis for increasing the efficiency of the process of physical preparation were established by us interconnections between the increment in physical qualities of boys of different somatotypes from 7 to 8 years. The determination of the direction of physical load for the development of physical qualities of boys of different somatotypes at 7–8 years was the goal of our research, in which we solved the following tasks, namely, the study of the peculiarities of the interconnections between the annual increment in the physical qualities of boys of different somatotypes at 7–8 years. The mentioned researches were cross-objective and used various directions and number of tests, and longitudinal single studies alone, which does not contribute to the establishment of regular tendencies and somatotype-specific peculiarities of the physical qualities' increment, the interconnections between such changes of boys at the stage of 7–8 years. All of the above-mentioned determined the choice of the subject of our research. The results of the experiment, organized by the longitudinal method, made it possible to draw the following conclusions: statistical interconnections between physical qualities in the sensitive period of their development, between these and other qualities under study differ for boys of different somatotypes by the number, magnitude and value of the coefficients of pair correlation, which indicates unequal interdependence of natural development of their physical qualities, and in practice manifests itself in the form of various variants of the transfer of the training effect when using the physical loads of a certain orientation.

Key words: boys, physical qualities, statistical interconnections, sensitive period, somatotype.

Зубаль М., Райтаровська І. Статистичні взаємозв'язки між приростом фізичних якостей у хлопчиків 7–8 років із різними соматотипами. Рівень фізичного розвитку, здоров'я, підготовленості як критерії для реалізації диференційованого, індивідуального підходу до учнів у процесі фізичного виховання визначає чинна програма. Проте ці критерії відзначаються лабільністю, тобто зміною відповідних характеристик під впливом різних зовнішніх чинників, а отже лише частково відображають індивідуальні особливості підлітків. З іншого боку виокремлюються показники, що відображають різні сторони життєдіяльності організму людини і тривалий час залишаються без змін – генетичні маркери, одним з яких є соматичний тип конституції. Вдосконалення фізичних якостей хлопчиків впродовж 7–8 років стало об'єктом нашого дослідження. Основою підвищення ефективності процесу фізичної підготовки були встановлені нами взаємозв'язки між приростом фізичних якостей у хлопчиків різних соматотипів від 7 до 8 років. Визначення спрямованості фізичних навантажень для розвитку фізичних якостей хлопців різних соматотипів у 7–8 років стало метою нашого дослідження, в якому ми вирішували наступні завдання, а саме вивчення особливостей взаємозв'язків між щорічним приростом фізичних якостей хлопців різних соматотипів у 7–8 років. Зазначені дослідження були кроссекціональними та використовували неоднакові за спрямованістю й кількістю тести, а лонгітюдинальні дослідження поодинокі, що не сприяє встановленню закономірних тенденцій і зумовлених соматотипом особливостей темпів приросту фізичних якостей, взаємозв'язків між такими змінами в хлопців на етапі 7–8 років. Усе вищезазначене й обумовило вибір теми дослідження. Результати експерименту, організованого лонгітюдинальним методом, дозволили зробити такі висновки: статистичні взаємозв'язки між фізичними якостями у сенситивному періоді їх розвитку, між цими та іншими досліджуваними якостями відрізняються в хлопців різних соматотипів за кількістю, величиною і значенням коефіцієнтів парної кореляції, що свідчить про неоднакову взаємообумовленість природного розвитку в них фізичних якостей, а на практиці проявляється у вигляді різних варіантів перенесення тренувального ефекту при використанні фізичних навантажень певної спрямованості.

Ключові слова: хлопчики, соматотип, фізичні якості, статистичні взаємозв'язки, сенситивний період.

Introduction

Successful solving of the problems of physical education in institutions of secondary education depends to a large extent on taking into consideration the complex of individual characteristics of pupils in the selection of optimal means, methods, parameters of physical loads and the development of pedagogical technologies and techniques that offer teachers the effective algorithms of action [1; 7], based on three lessons of physical education per week.

The current program [7] defines the level of physical development, health, preparation as criteria for the implementation of the differentiated, individual approach to pupils in the process of physical education. However, these criteria are marked by lability, that is, by changing

the corresponding characteristics under the influence of various external factors [2; 4], and therefore only partially reflect the individual characteristics of children.

However, indicators are displayed that reflect the different aspects of vital functions of the human body and for a long time remain unchanged – genetic markers, one of which is the somatic type of constitution [2; 5].

At the present stage, somatotypes are widely used in sporting activities as a prognostic indicator of motor capabilities and physical qualities of an individual [5].

The indicated studies were cross-sectoral and used different directions and number of tests, and longitudinal single studies alone [3; 4; 5], which does not contribute to the establishment of regular tendencies and somatotype-specific peculiarities of the increment rates of physical qualities, the interconnections between such changes of boys at 7–8 years. All of the above-mentioned has predetermined the choice of the subject of the study.

Materials and methods

Goal of research – to determine the orientation of physical load for the development of physical qualities of boys of different somatotypes at 7–8 years. According to the goal we were solving such tasks:

1. To study the peculiarities of development of physical qualities of the same boys of different somatotypes at 7–8 years.

2. To study the peculiarities of the interconnections between the annual increment in the physical qualities of boys of different somatotypes at 7–8 years.

3. To substantiate the orientation of physical activity for the development of physical qualities of boys of different somatotypes at 7–8 years in the process of physical education.

The object of research – the improvement of the physical qualities of boys during 7–8 years. Subject of research – interconnections between the increment of physical qualities of boys of different somatotypes from 7 to 8 years as a basis for increasing the efficiency of their physical preparation.

During solving set tasks, we used a set of such interrelated methods:

- theoretical – analysis, systematization and generalization of scientific literary sources, documentary materials;
- medical and biological – anthropometry, somatoscopy and somatometry, spirometry, pulsometry, dynamometry, tonometry;
- pedagogical – observation, testing;
- experiment – the leading method of research;
- mathematical-statistical – calculation of basic one-dimensional statistics.

Results

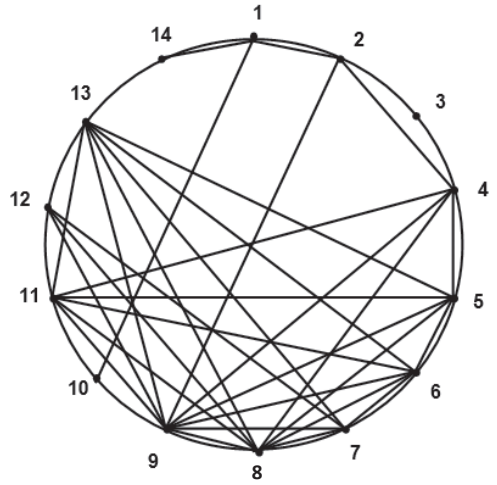
During the research at the stage of the ascertaining pedagogical experiment, the following methodological considerations were taken into account:

– the content of specific pedagogical actions in physical education should be based on knowledge of the laws of morphofunctional maturation of the individual organism. In this regard, it is important to study the issue of the direction in the ontogenesis of the school period of energy resources, since in the age-old structural transformation of the organism there are periods in which the main part of energy is spent on growth processes or on the differentiation of these transformations [5] (formation of a certain organism system [1; 4]). Knowledge of such periods is the basis for planning the amount of total training load during the development of physical qualities, since its compliance with the energy capabilities of the organism contributes to the coordination of pedagogical actions with natural morphofunctional development [5];

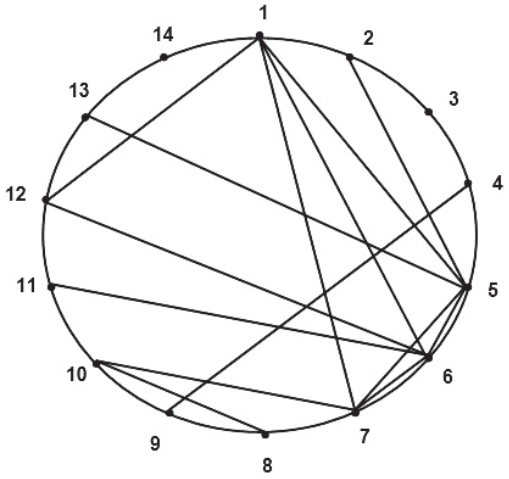
– the outright development of any physical quality is always noted by the transfer of the training effect. In this regard, data on the nature and magnitude of the correlation interconnections between the annual increment of physical qualities are important because taking into consideration such data permits, firstly, to optimize the use of the time of employment, that is, not to spend on quality, which is marked by positive statistical interconnections with what is expected to be developed. Taking into account the above-mentioned, for the same boys of different somatotypes from 7 to 8 years, the annual values of display, increment rates and correlation interconnections between the increment of physical qualities were studied. The obtained data testified to the following.

Asthenoid somatotype. From 7 to 8 years, the high rates of growth of the results of mill dynamometry and the bent suspension were in a positive interconnection, indicating the ability, when developing absolute force, to improve the static endurance of boys (Fig. 1).

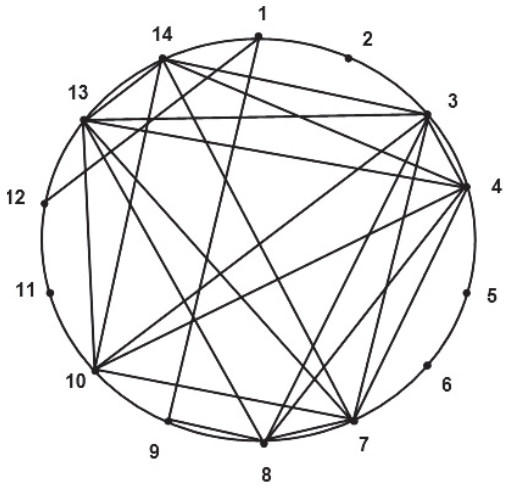
Also, the development of absolute force contributed. to the improvement of mobility in the shoulder joints, as the negative interconnection between the changes in their indicators was interpreted as follows: with the growth of the results of the mill dynamometry, the results of the wrench of the measuring line behind the back are reduced, which in the latter case reflects the improvement of mobility in these joints. From the reliable coefficients of the pair correlation established between improving the results of the long jump and some other indicators, it was logical to explain only the interconnection of the first with a 6-minute run and suggested an opportunity to improve endurance by developing speed-power qualities in jumps.



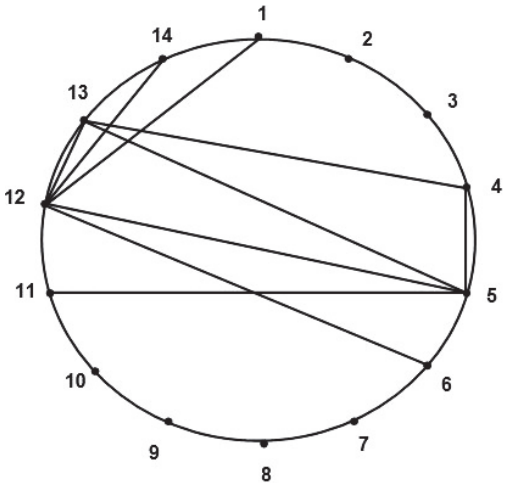
Asthenoid somatotype



Thoracic somatotype



Muscular somatotype



Digestive somatotype

Figure 1 Statistical interconnections between the increment in physical qualities of boys of asthenoid, thoracic, muscular, digestive somatotype at 7–8 years

N o t e: 1 – mill dynamometry, 2 – bent suspension, 3 – 5-second run in place, 4 – бiг 100 м, 5 – 20 m flying start run, 6 – throwing a stuffed ball, 7 – standing long jump, 8 – 6--minute run at a distance, 9 – tilt forward standing, 10 – dislocate the measuring line behind the back, 11 – 3x10 m shutte run, 12 – throwing a tennis ball on a range with a leading hand, 13 – throwing a tennis ball on a range with a non-leading hand, 14 – three forward rolls

Negative interconnection between the growth in the results of the 6-minute and shuttle run reflected a positive trend, as interpreted as follows: with the increase of the result of the first indicator, the result of the second indicator decreases, which in both cases indicated an improvement in overall endurance and coordination in cyclic locomotives, respectively. The above has allowed to report that the purposeful development of coordination in cyclic locomotions, which according to researchers [4; 5] should be carried out at junior school age, according to our data, will also contribute to the improvement of overall endurance. In addition, the use of such loads will increase the speed of endurance and maintain at the achieved level of individual speed, which from 7 to 8 years were observed respectively the average rate of increment and the tendency to decrease, as evidenced by the interconnections between the change in shuttle run and the 100 m run, shuttle run at 20 m run.

As for other indicators with a high increment of results, then the following is established. The improvement of the results of the 5-second run was not statistically related to the change of any indicator. Reliable correlation coefficients between improving the results of throwing on a range with a leading hand and a long jump, between the first and the 6 minute run, the tilt forward standing, as well as between changing the results of throwing at a range with a non-leading hand and 20 m run, the first and the long jump, 6 minute run, shuttle run could not be logically interpreted. The statistical interconnections between the change in the results of throwing with non-leading hand and throwing a stuffed ball showed the possibility of improving speed-power qualities in throws in the development of coordination abilities in throws on a range and a certain improvement of the latter in the development of mobility in the lateralis region of spine.

Obtained data allowed us to conclude that during this period it is necessary to use physical activity aimed at improving the frequency of movements, absolute force, flexibility, speed-power qualities in jumps, the investigated coordination abilities, except for those engaged in acrobatic motor actions.

The analysis of the pair correlation coefficients, which showed changes in the parameters of the thoracic, muscular and digestive somatotypes of boys at 7–8 years, was carried out using the above-mentioned approaches to their interpretation, and found the following.

Thoracic somatotype. Taking into account the nature of the statistical interconnections between the changes in the indicators, which were marked by the high increment of the results, as well as the data of scientific literature [2; 5] about the unpreparedness of the organism of 7-year-old children to physical activity, aimed at the development of absolute power, and especially static strength endurance, from 7 to 8 years it is necessary to improve the speed of separate motion, speed-power quality in jumping and throwing, general endurance, mobility in shoulder joints, coordination abilities in cyclic locomotions and acrobatic motor actions (see Fig. 1).

In connection with the above, in this period it is necessary to purposefully influence the speed endurance, speed-power qualities in throws, mobility in shoulder joints, coordination in throwing on a range with a leading and non-leading hand.

Muscular somatotype. From 7 to 8 years for boys, this significant increase in the frequency of movements was characterized by reliable correlation bonds with similar changes in speed-strength qualities in jumps, mobility in the shoulder joints, increased speed endurance – with overall endurance, speed-strength qualities – with mobility in the shoulder joints (see Fig. 1). At the same time, the indicated changes in the frequency of movements were negatively associated with changes in the speed, overall endurance, the average and low growth rate, respectively to coordination in throwing with non-leading hand and acrobatic motor activity. Similar correlation interconnections are also established between changes in speed, general endurance and speed-power qualities in jumps, and the latter in coordination in throwing with non-leading hand, acrobatic motor actions, overall endurance, mobility in the lateralis region of spine, last and absolute force. Regarding coordination in cyclic locomotions and absolute force, then their significant improvement was not statistically related to the change in the indicators of other physical qualities.

The obtained data showed that during this period, the high increment of the frequency of movements to some extent due to similar changes in speed-strength qualities in the jumps, both qualities – changes in mobility in the shoulder joints, the growth of overall endurance – the growth of high-speed endurance.

Significant improvement in absolute force and coordination in cyclic locomotypes was due to other factors, and insignificant movement of improvement of other qualities under study, with the exception of static strength endurance - marked changes in physical qualities. In this regard, it is necessary to use loads to improve absolute force, frequency of movements, overall endurance, speed-power qualities in jumps, flexibility and coordination in cyclic locomotions.

Digestive somatotype. From 7 to 8 years of age, the nature of statistical interconnections identified in physical qualities with a high rate of increment was noted as follows. Improvement of speed-power qualities in throwing contributed to an average increment in coordination in throwing on range with a leading hand, improved coordination in cyclic locomotives, on the contrary, to some extent, caused a decrease in the speed of a separate movement (see Fig. 1).

With regard to speed-power qualities in jumps and overall endurance, then their significant improvement was not statistically related to changes in the indicators of other physical qualities. The obtained data indicated the need to use physical activity in this period to improve speed-strength qualities, overall endurance and coordination in cyclic locomotions.

Discussion

The obtained data indicated that in this period it is necessary to improve the speed-power qualities in jumps, general endurance, mobility in the lateralis region of spine, coordination in acrobatic motor actions, cyclic locomotions and absolute force, which will contribute to their significant improvement, and the development of the latter will also create suppositions for improved coordination in cyclic locomotives.

The results of our experiment, organized by the longitudinal method, made it possible to draw the following conclusions: the statistical interconnections between the physical qualities with high increment (the sensitive period of their development), between these and other investigated qualities differ for boys of different somatotypes by number, size and value of the coefficients of pair correlation, which testifies to the uneven interdependence of natural development in their physical qualities, but in practice displays itself in the form of various variants of transfer of training affect while using physical loads of certain direction.

Taking into account these data will help to optimize the process of purposeful development of physical qualities, first of all, in the aspect of the release in each occupation of a certain time, since the maximum effect will be achieved using the minimum number of different directions of loading (Table 1).

Table 1

Direction of physical loads for development of physical qualities of boys of different somatotypes at 7–8 years

Somatotype	Physical qualities
Asthenoid	– maximum frequency of movements; – absolute force; – flexibility; – speed-power qualities in jumps; – coordination in throwing with leading hand; – coordination in throwing with non-leading hand; – coordination in cyclic locomotives
Thoracic	– the speed of a separate movement; – power-speed qualities in jumps; – power speed qualities in throwing; – general endurance; – mobility in the shoulder joints; – coordination in cyclic locomotions; – coordination in acrobatic motor activity
Muscular	– absolute strength; – maximum frequency of movements; – general endurance; – speed-power qualities in jumps; – flexibilities; – coordination in cyclic locomotions
Digestive	– speed-power qualities in jumps; – speed-power qualities in throwing – general endurance; – coordination on cyclic locomotions

Conclusions

1. The study of literary sources shows the inadequate efficiency defined by the school curriculum of physical education of the criteria for differentiation of pupils as one of the important conditions for the successful solving of health-oriented tasks, and allows to assert the necessity to consider the sensitive periods of development of physical qualities during the targeted influence on them in the process of physical education of pupils, and some discrepancy of age limits of these periods according to the current program and the data of various specialists. One of the reasons for this is the significant discrepancies between peers of the same sex in terms of morphofunctional indicators, the level of development of physical qualities, psychomotor and functions that are caused by the somatic type of constitution.

At the same time, the problem of the presence or absence of discrepancies in the statistical relationships between physical qualities of boys of different somatotypes at 7–8 years is not solved in this aspect.

2. Statistical interconnections between physical qualities with high increment, between them and other qualities under study prove a similar tendency, which consists of decreasing the number of such interconnections with age, as well as the existence of qualities that significantly improve in a certain period but do not reveal correlation relationships with the change of other physical qualities. The peculiarities consist in different amounts, character and strength of correlation relationships in peers of different somatotypes in each period of 7–8 years, which testifies to the uneven interconditionality of the development of their physical qualities under the influence of physical load with the same parameters.

3. With respect to the cross adaptation data that reflected the obtained values of the coefficients of the pair correlation between the increment in physical qualities, it was possible to release at each lesson the time devoted to the solution of the tasks, namely the development and improvement of physical qualities.

The study does not claim to comprehensive solution of all aspects of the problem. Further research is advisable to focus on optimizing the ways of using the data obtained to improve the efficiency of physical education in solving the standards for assessing the physical preparation of pupils.

Conflicts of interest. There are no conflicts of interest. The studies were performed at our own expense. No grants were used.

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The role of the authors consisted in the accumulation of experimental material on the peculiarities of the interconnections between the increment in physical qualities of boys of different somatotypes under the influence of the current content of physical education at secondary education institutions.

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