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## Sensitive Periods in the Ontogenesis of a Person

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### Abstract

The article considers issues related to the development of motor abilities of a person in the process of ontogenesis. The author presents the analysis of the manifestation of sensitive (critical) periods in the development of motor abilities of individuals of different sex and age, which makes it possible to develop certain functions of the organism of a person purposefully and efficiently as well as to form stable motor skills. The article considers age and sex transformations of morphological characteristics: total body measurements, body mass, chest size and lungs volume as well as sex differentiations in the manifestation of sensitive periods. Dynamics of the quantity of the manifestation of sensitive periods in the development of motor abilities of both males and females within the range of 2 to 22 years old is studied. Motor abilities, which must be developed at every age period, are listed.

**Keywords:** motor abilities, age dynamics, sensitive (critical) periods.

### 1. Introduction

While considering the issue of age-related changes in the development of motor abilities, the following most important points should be noted. In a number of experimental studies ([Alabyshev, 1980](#), [Balsevich, 2000](#), [Balsevich, 1996](#), [Volkov, 1984](#)) it was established that in the process of growth and development of the human body, there are special periods of its increased sensitivity to environmental influences. During these periods certain functions effectively develop and motor skills are forming. Such sensitive periods in the development of an individual in the process of ontogenesis are called "critical" or sensitive ([Balsevich, 2000](#)). During these periods, the body is much better adapted to the action of negative environmental factors, which is associated with its increased sensitivity to external influences. Knowing the limits of the "critical periods" and the optimal dose of exposure, one can purposefully control the individual program of a person's physical development by identifying the leading factors of development for each stage of ontogenesis ([Volkov, 1984](#)).

The purpose of the work is to study the age dynamics in the number of manifestations of sensitive, or "critical", periods in the range from 2 to 22 years for both sexes based on the analysis of a generalized material of research on the age characteristics of the development of human motor abilities.

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## **2. Methods and organization of research**

The authors for the first time carried out an analytical analysis of research materials (Alabyshev, 1980, Balsevich, 2000, Balsevich, 1996, Volkov, 1984, Guzhalovskiy, 1978, Guzhalovskiy, 1984, Gladysheva, 1976, Balsevich, 2000, Balsevich, 1996, Volkov, 1984, Guzhalovskiy, 1978, Guzhalovskiy, 1984) by belarusian and russian scientists in the field of theory and methods of physical culture, with the result that a new interpretation of data on issues related to the manifestations of sensitive periods in the development of human motor abilities was obtained.

## **3. Results and its discussion**

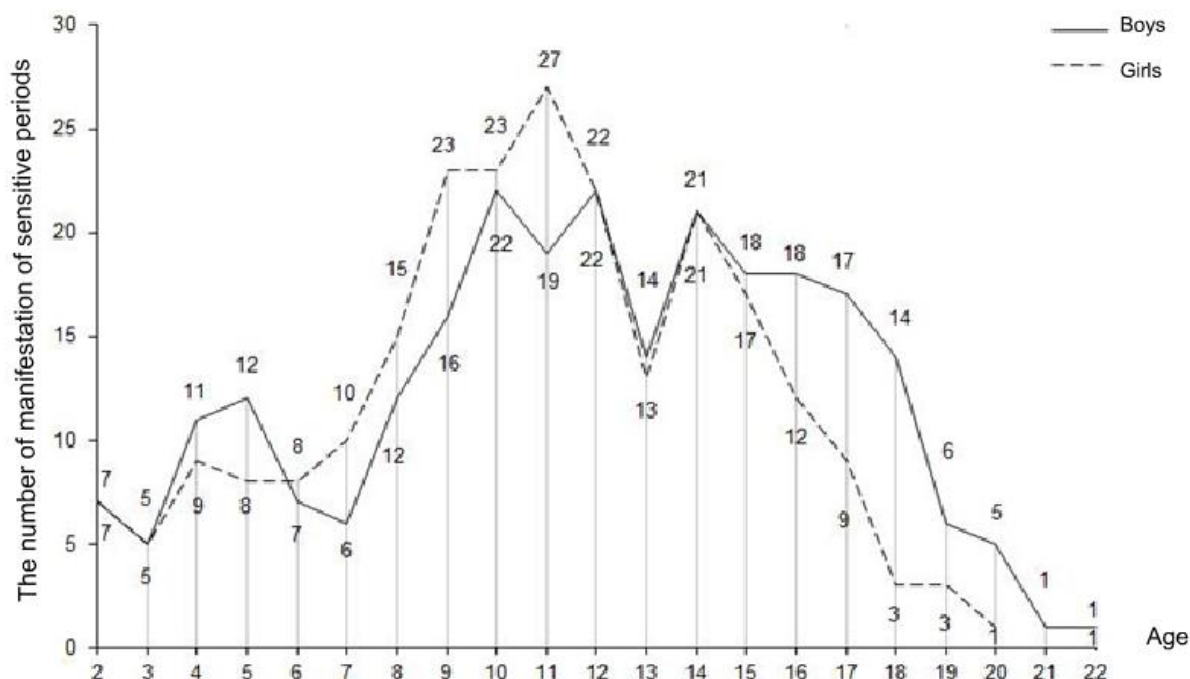
Analysis of the dynamics of manifestation of sensitive periods for a person (pic.) of two, three years of sensitive periods for both sexes are synchronized. At this age, develop speed-power abilities, coordination of moving during movement and running, the ability to maintain body balance, flexibility and also a person gains weight.

At the age of 4, both boys and girls have the fast improvement of jogging abilities, static strength, general endurance, general coordination, coordination while running and throwing an object. There are changes in morphological characteristics: the circumference of the chest. At this age, gender differences appear in the manifestation of sensitive periods. In addition to these, boys have growth of overall strength, general and static endurance.

At the age of 5, all these children have different indicators of speed and flexibility, development of strength, spatial and temporal differentiation. As at the age of 4 boys have the growth of total strength, as well as dynamic strength.

At the age of 6, girls and boys continue to have fast growth of speed, dynamic and general characteristics, spatial and temporal characteristics. Boys have the improvement of dynamic strength; girls have the improvement of coordination during run-up in long jumps. From 6 to 9 years, there is a growth in the chest cells.

The seven-year age is the beginning of a fast rise in the increase in the number of sensitive periods in the development of motor abilities for girls and boys, besides girls exceeds the indicators of boys (10 to 6). This dynamic continues up to 11 years for girls and 12 years for boys, the beginning of periods when a marked reduction in the number of sensitive periods in the development of motor abilities for both sexes begins. For seven-years-old girls there is an increase in coordination indices is observed during the run-up in long jumps and height while throwing the ball, rhythm of movements, balance, flexibility. Synchronous increase of indicators for boys and girls occurs with the development of various types of speed, frequency of movements, coordination while running. In addition, the boys in the period from 7 to 11 years have an accelerated growth of coordination abilities in such a specific form of athletics as a hurdle race.



**Fig. 1.** The dynamics of the manifestations of sensitive periods in the development of motor abilities in individuals of different sexes and age

The period of 8 years old for girls is characterized by an increase in the indices of speed, static endurance, coordination during a run-up in long and high jumps, a rhythm of movements, coordination while throwing the ball, and the development of spatial and temporal differentiations. Boys have growth of speed-power indicators. Both girls and boys have growth of speed in the frequency of movements, the latent period of the motor response, general and coordination while running, rhythm of movements, body balance, flexibility, control of the duration of muscle tension.

At the age of 9, sensitive periods for girls are observed in terms of speed in the speed of a movement, total strength, endurance, manifested in static and dynamic modes, coordination while jumping and throwing, body weight increases. Boys develop coordination in gymnastic and acrobatic exercises, improve performance in swimming and hurdle race. The representatives of both sexes have growth of various types of speed, indicators of frequency of movements, speed-power abilities, general endurance, general coordination of running, rhythm of movements and body balance, control of the duration of muscular tension, spatial and temporal differentiation, flexibility; also increases the circumference of the chest.

At the age of 10, girls experience an increase of speed (movement frequency), endurance of static and dynamic modes, coordination of jumps and throws, coordination abilities, lung volume increases; boys experience endurance indicators in a zone of high intensity, coordination while a run-up in long jumps, gymnastic and acrobatic exercises, swimming, cycling, football, hurdle race, rhythm of movements, spatial and temporal differentiation. Both girls and boys have indicators of different types of speed, speed of a movement, latent time of motor reaction, speed-strength abilities, general endurance, coordination in running, balance, accuracy of movements, flexibility, duration of muscle stresses; increases the circumference of the chest.

At the age of 11, girls have the number of manifestations of sensitive periods reaches the highest value (27), after which they decrease until the age of 13. Moreover, for girls this process is clearly pronounced due to the processes of puberty, which is typical during these age periods. For boys from 10 to 12 years, there is a wavy dynamic in the quantitative manifestation of sensitive periods, but it is weakly expressed.

Thus, for girls of 11 years old, there are sensitive periods in terms of speed in the frequency of movements, endurance of static and dynamic (in the submaximal intensity zone) modes, coordination of jumping and throwing, swimming, coordination abilities of general, flexibility; total body size increases; for boys these sensitive periods are expressed in terms of speeds manifested in different types and in speed of a movement, coordination during a run-up in long jumps, while

throwing the ball into the basket, cycling and football; for both sexes it is expressed in terms of speed in the latent time of the motor response, total strength, speed-strength abilities, total endurance and endurance, manifested in a dynamic mode in areas of moderate and high intensity, coordination while running, balance and accuracy of movements; there is an increase of body weight, chest circumference, lung volume.

At the age of 12, sensitive periods in the development of motor abilities of girls are observed in terms of endurance in a static mode, coordination during run-up in long jumps and throwing the ball, rhythm of movements, and body balance; this period for boys is characterized by developing of indicators of speed in the frequency of movements and latent time of the motor reaction, coordination in acrobatic jumps and throwing the ball into the basket, cycling, football; for both boys and girls it is expressed in developing of terms of overall strength and endurance, speed-strength abilities, endurance in a dynamic mode in areas of high and submaximal intensity, coordination while running, swimming, spatial orientation, flexibility; also lung volume increases.

At the age of thirteen, girls experience an increase in indicators of speed, rhythm of movements, body balance, increasing muscle mass; there is a development of indicators of speed in the frequency of movements, general strength, speed-strength abilities, coordination while cycling, football, general coordination for boys; they also have increase of lung volume as girls. Both boys and girls have development of indicators of overall strength, speed-strength abilities, general endurance and endurance, manifested in a dynamic mode, coordination while running, swimming, flexibility; body weight increases.

Girls and boys from 12 to 14 years have the same number of manifestations of sensitive periods in the development of motor abilities. From 13 to 14 years, both girls and boys have another increase (peak of rise) in the number of sensitive periods in the development of motor abilities. Moreover, from the age of 15, this number for boys begins to exceed girl's indicators. This dynamic will persist throughout subsequent age periods (up to 22 years). From the age of 14, a gradual decrease in the number of sensitive periods for both sexes starts.

At the age of 14, sensitive periods for girls are observed in terms of speed in the frequency of movements, endurance in the zone of maximum intensity, coordination during a run-up in long jumps and jumps with a change in direction of movement, swimming, rhythm of movements, coordination abilities; an increase of total body size and muscle mass occurs. For young men this period is characterized by increasing of different types of speed, dynamic endurance in zones of moderate and submaximal intensity, coordination of acrobatic jumps and while throwing the ball into the basket, cycling, football, and body balance; lung volume increases. Boys and girls have increase of overall strength, speed-strength abilities, general endurance and endurance of a dynamic mode in a zone of high intensity, coordination during a run-up in long jumps, while throwing the ball, spatial orientation, flexibility; increases the circumference of the chest.

At the age of 15, girls experience an increase in speed indicators in the frequency of movements, endurance, manifested in areas of high and maximum intensity, coordination during a run-up in long jumps and jumps with a change in direction of movement, complex coordination, accuracy of movements; total body size and muscle mass increase. Young men experience increase of different types of speed, speed of a movement, coordination while acrobatic jumps, while throwing the ball and throwing the ball into the basket, swimming and soccer, balance; body weight increases. Both boys and girls have increase of overall strength, speed-strength abilities, general endurance and endurance in static and dynamic modes, coordination during a run-up in jumps, spatial orientation, flexibility; increases the circumference of the chest.

At the age of 16, girls at an accelerated pace have observed an increase in the indices of endurance, manifested in a static mode and in zones of large, submaximal and maximum intensity, coordination during exercises with changing direction of movement, complex coordination, accuracy of movements; for young men there are indicators of speed in different types and speeds of a movement, general endurance and endurance, manifested in a dynamic mode, coordination while running and a run-up in jumps, acrobatic jumps, while throwing the ball and throwing the ball into the basket, swimming, general coordination; total body size and muscle mass increase; girls and boys have indicators of overall strength and speed-strength abilities, spatial orientation, flexibility; increases the circumference of the chest.

At age 17, girls have sensitive periods in the development of motor abilities in terms of endurance in areas of high and submaximal intensity, coordination while a run-up in long jumps

and jumps with a change in direction of movement, flexibility; for young men this period is characterized by speed improvement of movement while swimming, speed-strength abilities, endurance in the zone of moderate intensity, coordination during the run-up in jumps, acrobatic jumps and while throwing the ball, complex coordination, balance, accuracy of movements, spatial orientation; total body size and muscle mass increase; boys and girls experience development of overall strength, endurance in a static mode and a zone of maximum intensity.

At the age of 18, girls improve coordination while a run-up in long jumps; boys have an increase in strength, manifested in swimming, endurance in static and dynamic modes, as well as in the zone of moderate, large, submaximal and maximum intensity, complex coordination, accuracy of movements; total body size, chest circumference, muscle mass increase; girls and boys have indicators of total strength.

At age of 19, girls experience gains in speed-power abilities; young men have indicators of endurance in all zones of intensity; both boys and girls experience development of coordination while running, general coordination. At 20, young men have indicators of endurance in a dynamic mode and in areas of high and submaximal intensity, coordination in acrobatic jumps, both boys and girls have improvement of overall coordination. At the age of 21, young men experience development of coordination of acrobatic jumps, at 22, young men and woman have improvement of their speed-strength abilities.

#### 4. Conclusion

The dynamics of manifestations of sensitive periods in the development of motor abilities shows that at the age of 2 and 3 sensitive periods for both sexes is synchronized not only by quantitative indicators, but also by morphofunctional characteristics. From the age of 4, sexual morphofunctional differences appear in the manifestation of sensitive periods. The age of 7 is the beginning of an increase in the number of sensitive periods in the development of motor abilities for girls and boys, and this number for girls exceeds the boy's indicators, and this dynamic continues up to 11 years for girls and 12 years for boys, the beginning of decline the number of sensitive periods for both sexes. The age of 11 for girls is characterized by reaching a maximum value in number of manifestations of sensitive periods, after which they are markedly reduced to 13 years, which may be due to the processes of puberty. For boys from 10 to 12 years, there is a wavy dynamic in the quantitative manifestation of sensitive periods, but it is weakly expressed. In the period from 12 to 14 years, both sexes have the same number of manifestations of sensitive periods. From 13 to 14 years, girls and boys have another increase in this number. Moreover, from the age of 15 these indicators for boys begin to exceed girl's indicators. From the age of 14, a gradual decrease in the number of sensitive periods for both sexes starts. This dynamic will persist throughout subsequent age periods up to 22 years.

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