



# Relationship of biological and pedagogical aspects in children's early sports training

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## Abstract

**Objective of the study** was to identify features of the age-related development of some body systems of 6-year-old children, depending on physical activity.

**Methods and structure of the study.** Peculiarities of age-related development were studied as a marker of the influence of various physical activities in 6-year-old children. Contingent: hockey players (41 people, training experience  $1,32 \pm 0,84$  years), football players (19 people, training experience  $1,79 \pm 0,79$  years) and untrained children (17 people). The following were studied: total dimensions and proportions of the body of the limbs, labile components of body weight; abilities: psychomotor (tests: tapping, RDO, PZMR, attention, noise immunity), cognitive (visual, verbal, spatial-logical, analytical-synthetic thinking); motor (30 m run; shuttle run  $3 \times 10$  m; running with alternation  $3 \times 10$  m (smooth, attached alternating, back forward); standing long jump; grip strength). Stepwise discriminant analysis was used to analyze the data.

**Results and conclusions.** A low level of discrimination between groups of six-year-old children with different physical activity was revealed in the presence of traces of external influence, differentiating the contribution of various activity support systems to the differences between groups. The greatest difference between athletes and untrained children is inherent in cognitive development, which reflects the leading role of consciousness in the development of skills of various properties and characteristics of learning. Motor and psychomotor abilities, which differ in the manifestation of the strength of the nervous system and the quality of coordination, are consistent with the priority of the importance of the development of movement control structures in accordance with the characteristics of motor activity and learning. Morphofunctional development does not reflect the characteristics of motor activity. It is assumed that already at the very early stage of systematic sports activities, the influence of means and methods of preparation is noted, which requires taking into account the individual and age-related cognitive development of the child.

**Keywords:** *morphofunctional and psychological characteristics, physical fitness, 6 years old, hockey, football, untrained children.*

**Introduction.** The problem of early sports training is updated by the developmental features of modern children: the deterioration of children's health against the background of the replacement of physical activity with attractive contact with the world through gadgets with access to the global network. The natural result of reality is overweight and obesity in children, which, according to WHO and Russian experts, has become a pandemic and increases from 6 to 10 years to a greater extent in boys, which limits physical activity, and as a consequence, physical fitness in one third of young children, limiting the sports reserve pool [12].

Changes in the regulations of the Federal Standards of Sports Training for 2022-2023, which deter-

mined 6-8 years as the age for enrollment in the initial training stage in 37 Olympic sports (64%), opened up opportunities for early involvement of children in sports in order to form a sustainable interest in activities, mastering motor skills and techniques, increasing the level of comprehensive physical fitness [7].

Despite the fact that physical activity in children is recognized as a means of long-term improvement of quality of life, there are serious disagreements regarding the initiation of systematic sports activities. The reasons for skepticism are frequent injuries and overtraining due to the child's insufficient readiness to learn [11]. Early start of sports activities occurs during periods of ontogenesis with biologically natural het-



erochrony and a sequence of alternating quantitative and qualitative transformations of the morphological, physiological and psychological spheres, which determine the range of opportunities and readiness to learn skills and develop skills that are promising for motor development, taking into account the features of the priority development of various systems organism in the form of sport [8].

**Objective of the study** was to identify features of the age-related development of some body systems of 6-year-old children, depending on physical activity.

**Methods and structure of the study.** Data is presented that allows one to evaluate: physique: total dimensions, proportions of the body and limbs; muscle and fat mass (anthropometry, caliperometry); abilities: psychomotor (NS-Psychotest Sport: tapping test, simple and complex visual-motor reactions: VMR, RDO and noise immunity (PU)), cognitive (visual and verbal-logical (ZLM and VLM); visual-spatial; analytical-synthetic (Raven's color progressive matrices - CPMR) thinking, attention (Bourdon's correction test), indirect memory and physical (30 m run; shuttle run 3x10 m; variable running - T-test: with alternation (smooth 10 m), attached variable 5 m x 2, back forward 10 m; grip strength, kg, % hand dynamometry DK-25) [1-6]. In a number of cognitive tests, additional processing time was taken into account: step-by-step discriminant analysis (Statistica 13.0).

Subject population: 77 six-year-old boys, including young athletes involved in hockey (41 people, experience  $1,32 \pm 0,84$  years) and football (19 people, experience  $1,79 \pm 0,79$  years) in sports and fitness groups, as well as untrained children of preschool educational institutions in Moscow (17 people). Each of the groups

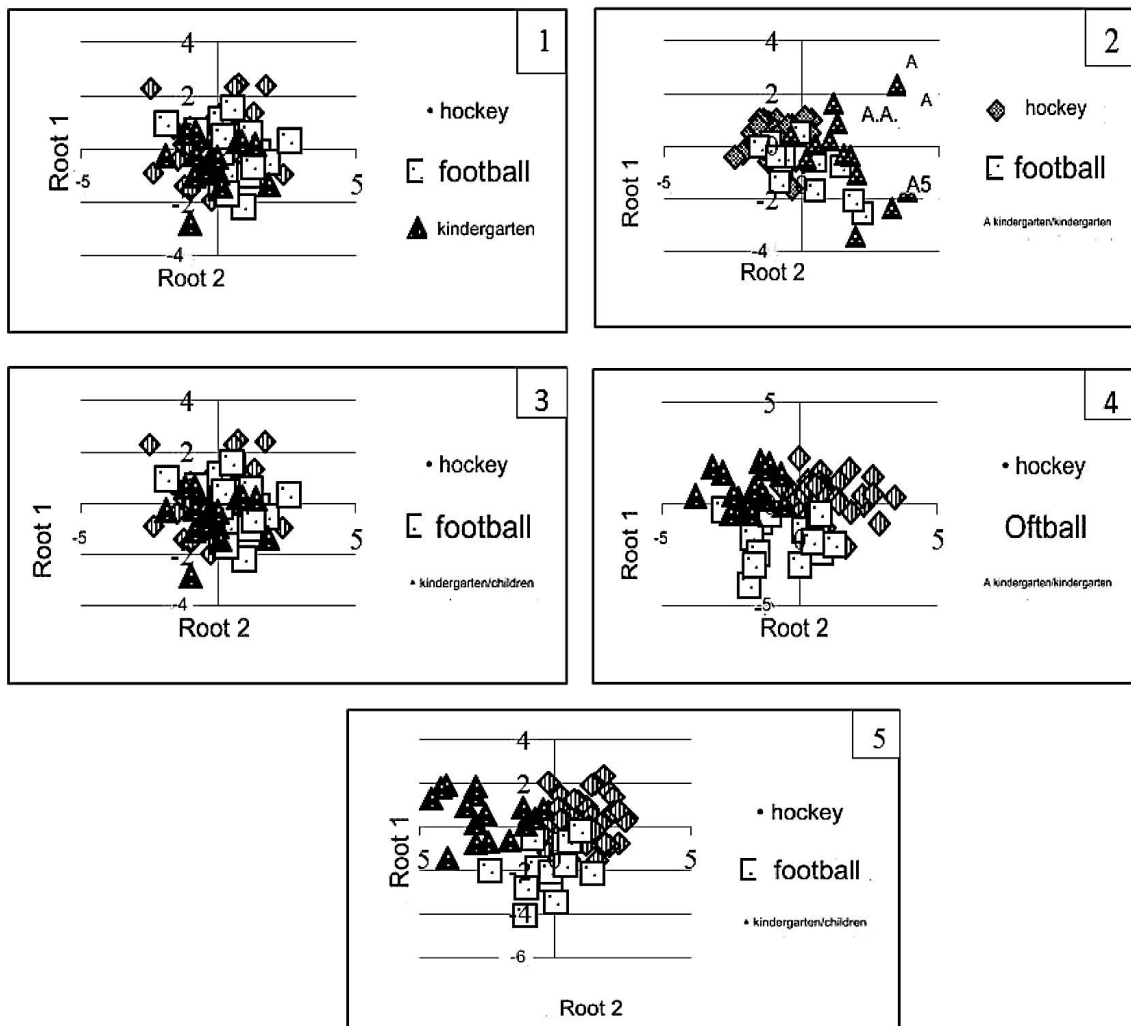
of young athletes of a particular sport trained according to a single plan: during the week, hockey players performed 5 training sessions on the ice for 75 minutes each and 2-3 general physical training training sessions for 60 minutes each; football players – 3 training sessions of 75 minutes. Untrained children had physical activity for 30-40 minutes 2 times a week. The examinations were carried out with the consent of the parents.

**Results of the study and discussion.** The ontogeny of children is determined by the differentiated contribution of various body systems to the course of the general development process under the influence of environmental factors. Indicators of physique, motor, psychomotor and cognitive abilities (critical threshold F-exclusion: 2,55). This made it possible to assess the contribution of the indicators of each of the blocks under consideration and the probability of discrimination (D, %) of groups of 6-year-old children based on physical activity (see table, figure).

Sizes, proportions of the body and limbs, labile components of body weight do not differ in the groups of hockey, football and untrained children, with the largest, but insignificant, contribution to the differences in the relative indicators of leg length and fat mass (%). Motor abilities highlight the superiority of groups of athletes relative to untrained children, differing to a lesser extent in physical abilities between hockey players and football players, mainly in terms of coordination abilities. Psychomotor abilities most significantly distinguish the leadership of sports groups in terms of the strength of the nervous system, mainly in motor reactions, and to a lesser extent in complex visual-motor reactions. The groups of children differ

*Discrimination indicators (D) of groups of 6-year-old children with different physical activity*

Indicator	F-remove	p-value	D, %	Indicator	F-remove	p-value	D, %
<b>Body type</b>				<b>Motor abilities</b>			
Leg length/body length	2,19	,110	55,1	Shuttle run	4,75	,012	75,0
Fat mass,%	1,74	,181		Grip strength, %	4,43	,016	
				Running T-test	3,26	,045	
<b>Psychomotor abilities</b>				<b>Cognitive abilities</b>			
Tapping test, quantity	6,31	,003	71,8	CPMR (B), point	7,45	,001	87,3
RDO, ms	3,28	,044		HWP, min	5,06	,010	
PU, ms	3,24	,046		CPMR, min	4,68	,013	
<b>A set of informative indicators</b>				VLM, point	4,31	,018	
VLM, point	4,98	,010	87,3	ZLM, point	3,62	,034	
Grip strength, %	4,97	,010		Short-term memory	3,53	,036	
CPMR, min	4,09	,022					
Running T-test	3,64	,033					



Scatter diagram of groups of athletes and untrained children in the canonical space of discriminant functions taking into account physique (1), motor (2), psychomotor (3), cognitive (4) abilities and a set of informative discrimination indicators (5).

most significantly in the level of cognitive abilities with the greatest contribution from indicators of analytical-synthetic thinking and processing of visual and verbal information. Discriminant analysis, taking into account the selected informative indicators, determined the range of leading markers that differentiate groups of children, including indicators of the cognitive spectrum, combining analytical and synthetic processing of verbal and visual information, and physical fitness, including manifestations of the qualities of strength and coordination.

The results of the study indicate a low level of separation of groups of 6-year-old children with different physical activity. However, playing sports from six months to 2,5 years in preschool age already forms traces of external influence, differentiating the

contribution of activity support systems to the differences between children, taking into account the type of physical activity. The greatest distinction between young athletes and untrained children is characteristic of indicators of intellectual development, which is manifested in both autonomous and complex analysis of indicators of the cognitive spectrum, reflecting the dominant role of consciousness not only in the development of skills of various properties, but also in the characteristics of learning [8]. Motor and psychomotor abilities, differing in the manifestation of the strength of the nervous system and the quality of coordination, are consistent with the priority of the importance of the development of movement control structures in accordance with the nature of motor activity, the direction of means and methods of training [9, 10].



On the contrary, the processes of growth and morpho-functional development at this age are not affected by various motor activities.

**Conclusions.** The data obtained allow us to assume that already at the very early stage of systematic sports activities, vectors of influence on the development of the child's body of means and methods of training in accordance with the requirements of sports appear, which takes into account the individual and age-related cognitive development of the child in the first position when planning training. The issue requires further research within the framework of long-term monitoring.

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