

FACTOR STRUCTURE OF PHYSICAL ABILITY OF 9-YEAR-OLD PUPILS OVER A 12 YEAR-PERIOD

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ABSTRACT

Nutrition and physical activity are defining factors for health and essential for optimal growth and development of pupils in the early stage of primary education when habits associated with healthy lifestyle are formed. Hypodynamia, reduced physical ability, obesity, spinal distortions, increasing aggression and susceptibility to negative events in society are common among young people in the third decade of the third millennium. The aim of the study is to explore the factor structure and to identify the main factors of physical ability among 9-year-olds over a period of 12 years (2007-2019). The study, conducted every 4 years from 2007 to 2019, focuses on the physical activity of 9-year-old pupils divided equally into groups with each group containing 50 pupils. The four groups of pupils are from different schools in Veliko Tarnovo – from Emilian Stanev Highschool in 2007, from Vela Blagoeva Highschool in 2011, from P. R. Slaveykov Primary School in 2015 and from Dimitar Blagoev Primary School in 2019. The study was conducted at the beginning of each school year.

Over 10 indicators of sports preparation were subject to factorization over the 12-year-period. Only indicators reflecting the state of physical ability were taken into consideration: 1. standing long jump; 2. throwing of a medicine ball; 3. 50 m running; 4. 200 m running; 5. depth of inclination.

Physical activity had advantage in the four groups as demonstrated by the identification of the first factor as Speed-power in 2007, 2011, 2019 and Explosive power in 2015.

Key words: pupils, physical ability, factor structure

ФАКТОРНА СТРУКТУРА НА ФИЗИЧЕСКАТА ДЕЕСПОСОБНОСТ НА 9-ГОДИШНИ УЧЕНИЦИ ЗА 12-ГОДИШЕН ПЕРИОД

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РЕЗЮМЕ

Храненето и физическата активност са детерминанти на здравето и необходимо условие за осигуряване на оптимален растеж и развитие на учениците в началния етап на основната образователна степен – възраст, в която се формират навиците, свързани

със здравословния начин на живот. Хиподинамия, понижена дееспособност, наднормено тегло, гръбначни изкривявания, повишаваща се агресия и поддаване към негативните явления в обществото са явления, характерни за младите хора в третото десетилетие на третото хилядолетие. Целта на настоящото изследване е разкриване на факторната структура и идентифициране на основните фактори на физическата дееспособност при 9-годишни ученици за 12-годишен период от време (2007–2019 г.). Изследваните лица са 9-годишни ученици, разпределени по равен брой – 50 във всяка група, през 4 години от 2007 до 2019 г. Четирите съвкупности са от различни училища на гр. Велико Търново – изследваните през 2007 г. са от СУ „Емилиян Станев“, през 2011 г. от СУ „Вела Благоева“, през 2015 г. от ОУ „П. Р. Славейков“ и през 2019 г. от ОУ „Димитър Благоев“. Изследването е проведено в началото на всяка учебна година.

На факторизиране подлежат над 10 показателя на спортната подготвеност през изследвания 12-годишен период от време. Под внимание са взети само признаците, които отразяват състоянието на физическата дееспособност: 1. Скок на дължина от място с два крака; 2. Хвърляне на плътна топка; 3. Бягане на 50 m; 4. Бягане на 200 m; 5. Дълбочина на наклона.

Физическата дееспособност е с преимущество при четирите изследвани групи, което се доказва от идентифицирането на първи фактор като „Скоростно-силов“ през 2007, 2011, 2019 г. и „Взривна сила“ през 2015 г.

Ключови думи: ученици, физическа дееспособност, факторна структура

INTRODUCTION

The detailed socio-demographic review shows that Bulgaria is rather a small country with population of 7.5 million people. The negative characteristics of demographic trends are far more impressive than those in most countries in the West. The differences between children in their early life experience appear as limitations as far as education, leisure and cultural activities are concerned. This fact affects seriously the selection of future elite athletes.

According to the World Health Organization (WHO), the term physical activity (PA) denotes "any movement of the body that is realized through the contractions of skeletal muscles and which leads to an increase in energy expenditure above the level of basic metabolism".

The educational process in physical education and sports in the initial stage of the basic educational level facilitates laying the foundations of the formation of positive attitude of pupils towards sports, their own physical development and physical ability, motivation, needs and interests (Aleksieva, Milonas 2019).

According to M. Borukova "... the aim of the educational system is to provide conditions for proper development and support of children's psychophysical health, as well as their harmonious development as capable and active people" (Borukova, 2019).

It has been proved that there is a certain connection between the volume of physical activity and the morbidity risk. Low physical activity, lack of physical activity and physical inactivity are synonymous terms used to describe the life of people who do not perform enough physical activities to meet the recommended levels of physical activity, essential for maintaining good health and reducing risk factors.

Nutrition and physical activity are defining factors for health and essential for optimal growth and development of pupils in the early stage of primary education when habits associated with healthy lifestyle are formed. According to I. Peltekova “Sedentary lifestyle affects not only the physical but also the psycho-social development, especially with children” (Peltekova, 2010). Hypodynamia, reduced physical ability, obesity, spinal distortions, increasing aggression and susceptibility to negative events in society are common among young people in the third decade of the third millennium. According to recommendations provided by WHO for physical activity, children and adolescents aged 5–17 should perform physical activity at least 60 minutes per day of moderate-to-vigorous intensity (games, sports, movement, rest, physical education, planned exercises to be practised in the family, at school and in public organizations).

These facts have spurred our interest in the subject, which has led to motivation for retrospective analysis of the physical ability of 9-year-old pupils who were in the fourth grade during the 2007/2008, 2011/2012, 2015/2016 and 2019/2020 school years, i.e. four groups over a period of twelve years.

Factor analysis is one of the methods of multidimensional statistical analysis of indicator variations in order to find hidden, externally non-observable combinations of factors and regularities in their relations, as well as to detect hidden factors on the studied object. Factor analysis solves two main problems: finding the factors that determine certain process or phenomenon, outlining the structure of a complex phenomenon, which in the study is a resultative indicator (Ivanov, 2006).

Applying factor analysis makes it possible to understand thoroughly the structure of the studied phenomenon and to identify the most important aspects in physical education and sports training with pupils from the initial stage of basic education (Aleksieva, Petkova, 2018).

According to L. Kasabova “... optimization of educational and training process has always been the object of research by a number of scientists. It could help sports professionals to optimize the training process in relation to each of the studied indicators” (Kasabova, 2019).

The aim of the present paper is to study the factor structure and identify the main factors of physical ability with 9-year-olds for a period of 12 years (2007-2019).

In order to accomplish the stated aim in the course of the study the following **tasks** have been formulated:

1. Outlining the state of the main indicators having to do with the physical ability of the students for a period of 12 years.
2. Outlining the factor structure and identifying the main factors of physical ability with 9-year-old pupils.

METHODOLOGY

The subject of the study are indicators of physical ability of 9-year-old pupils.

The object of the study is physical education and sports training in in the initial stage of basic education.

The studied individuals are 9-year-old pupils divided equally – 50 in each group, every 4 years from 2007 to 2019. The four groups are from different schools in Veliko Tarnovo – from *Emilian Stanev* Highschool in 2007, from *Vela Blagoeva* Highschool in 2011, from *P. R. Slaveykov* Primary School in 2015 and from *Dimitar Blagoev* Primary School in 2019. The study was conducted at the beginning of each school year.

During the studied 12-year period, subject to factorization were over 10 indicators of sports preparation. Only indicators reflecting the state of physical ability were taken into consideration: 1. standing long jump; 2. throwing a medicine ball; 3. 50 m running; 4. 200 m running; 5. depth of inclination.

The obtained results were processed with a standard statistical program SPSS 21.

ANALYSIS OF RESULTS

It is well-known in sports statistics that factorial analysis is a natural continuation of the correlation analysis. During the studied 12-year period, over 10 indicators of sports preparation of pupils aged 9 years were subject to factorization. In our study only the factors reflecting the state of physical ability have been taken into consideration. The number of factors is many times smaller than the number of the tests, which leads to simplification of the correlation structure, and hence to a clarification of the factor structure. To be clearer, the factor weights are multiplied by 100, and for better perception of the physical ability structure, in the graphs below factor weights have been plotted at $l_{ij} \geq 0.500$.

Figures 1 and 2 show only the factors that determine the physical ability of the four samples from 2007 to 2019.

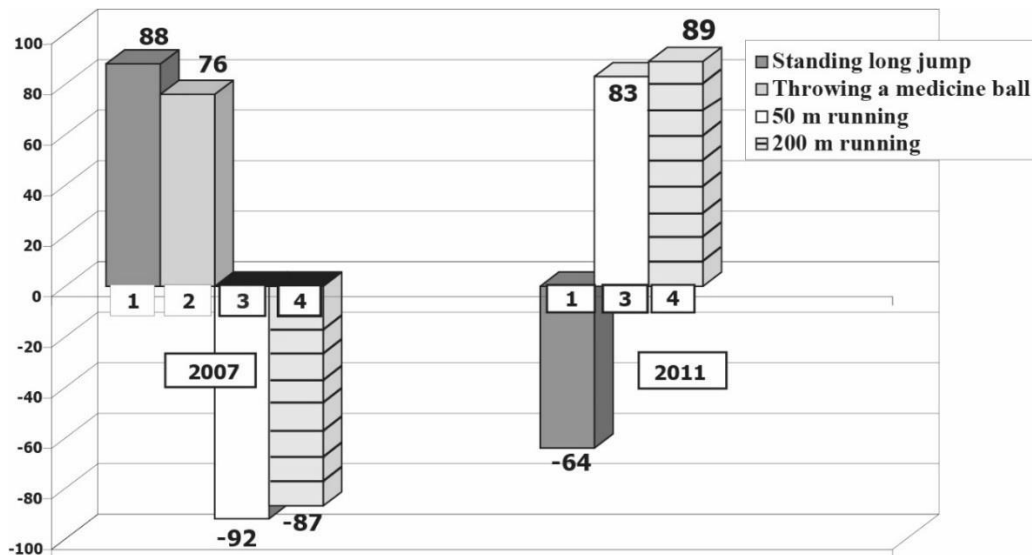


Figure 1. Factor structure of physical activity – 2007 and 2011

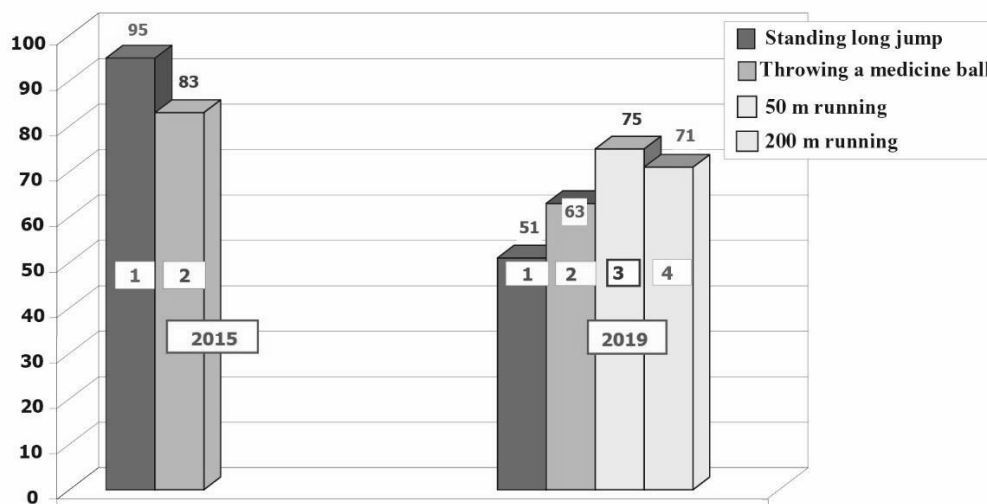


Figure 2. Factor structure of physical ability – 2015 and 2019

The factor characterizing the physical ability of 9-year-old pupils in 2007 is first and explains the highest percentage of the studied phenomenon initial variance (18,27%). With the highest factor weights are the indicators that have to do with the level of development, as well as the speed and endurance and the explosive power of the upper and lower limbs (Petkova 2012: 154). This makes it possible the factor to be identified as “*Speed-power*” (Figure 1).

It can be seen that the first factor in 2011 consists of three indicators of physical ability and describes the highest percentage of initial variance – 11,80%. It includes the following indicators: standing long jump (-0,640), 50 m running (0,830) and 200 m running, with factor weight 0,890 (Petkova 2014: 545). The factor is recognized as *Speed-power* (Figure 1).

With 9-year-old pupils in 2015, as shown in Figure 2, the factor, which comes first is determined by two indicators. The initial variance is 34,60%. The indicators with the highest factor weights here carry information about the level of development of both the explosive power

of the lower limbs (in horizontal and vertical efforts) and the explosive power of the upper limbs. The factor is identified as *Explosive power* (Figure 2).

The first factor in 2019 is identified as *Speed-power*, as it includes the indicators that characterize speed, endurance, explosive power of the upper and lower limbs. The initial variance, which it explains, has the highest percentage of the studied phenomenon (17,45%).

DISCUSSION

Speed-power abilities of pupils aged 9 years that the study focuses on undergo significant development. Using this age feature, in the work with 9 year olds, we focus exactly on motor skills, strength and speed development (Petkova, Aleksieva 2018: 219).

The first factors formed during 2007, 2011 and 2019 are named Speed-power, while only the one from 2015 is characterized as Explosive power. Generally speaking, factors also establish the highest percentage explained variance in the rotated factor matrices of the samples. The least affected by the operation of all factors are the indicators standing long jump ($h^2=42$) in 2019 and throwing a medicine ball ($h^2=57$) in 2011, while with the highest totality is the variable of the indicator 50 m running ($h^2=85$) in 2007.

In Borukova's study (2019: 80) the first factor in the factor structure of physical ability with 13-14-year-old male students is determined by three factors, explaining the highest percentage from the initial variance of studied indicators (68,39%). This factor is associated with the explosive power of lower limbs in horizontal efforts, speed and endurance of boys.

CONCLUSIONS

1. During the studied period of time, the four samples acquire their individual analogous rotated matrix, established by the studied indicators.
2. The studied groups in the analyzed periods of time show high percentage of total explained variance and changes mainly associated with factor weights of variables.
3. Physical activity has an advantage in the four groups studied, which is proved by the identification of the first factor as *Speed-power* in 2007, 2011, 2019 and Explosive force in 2015.

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