Reasoned Opinion

Physical performance and biological maturity of primary school children

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Article History
Received: Oct 7, 2025
Revised: Oct 14, 2025
Accepted: Oct 15, 2025

Abstract
The results of one-factor variance analysis indicate the necessity of incorporating into the physical training of primary school children methods and tools aimed at improving the efficiency of aerobic energy production, as an integral part of the internal structure of children's preparedness for strenuous muscular activity. Factor analysis revealed that the aerobic abilities of primary school children have a heterogeneous structure and are largely determined by capacity, power, the feasibility of potential aerobic power, and aerobic efficiency.

Keywords: Analysis of variance, dynamic mode, muscular work, aerobic capacity.

Introduction. Physical performance is an integral state of those functions of the cardiovascular, respiratory systems and energy metabolism that directly or indirectly ensure the performance of cyclic muscular work in a dynamic mode of a certain intensity and duration [1-4].

The current state of the cardiorespiratory system's readiness to perform such muscular activity reflects the degree of its adaptation and covers a range of issues, some of which - testing and organization - are central to the problem, since aerobic bioenergetics is one of the most important in the vegetative and metabolic support of manifestations of general endurance.

Clearly, the foundation for developing adequate methods for assessing physical performance is determining its structure. The information used for these methods is directly dependent on our understanding of the most essential properties and factors of the systems underlying the internal structure of the body's physical performance. This requires a clear understanding of what exactly should be tested, the research methods, and the evaluation criteria used.

Research method. Until recently, the practice of assessing physical performance, not only in adults but also in children and adolescents, has focused primarily on assessing the degree of maximization of the cardiorespiratory system, reflecting its functional limits - in other words, determining its capacity.

DOI: 10.56580/GEOMEDI70

The most illustrative example is the indirect determination of maximum oxygen consumption using the Astrand-Ryhming nomogram or its modification for preschool, primary, and secondary school-aged children.

Table 1. The results of one-factor variance analysis regarding maximum oxygen consumption

#	Indicator	Factor Weight
1	VO2 Max Maintenance Time	938
2	Total Specific Energy Expenditure	913
3	Total Aerobic Specific Energy Expenditure	869
4	Total Absolute Energy Expenditure	867
5	Total Absolute Aerobic Energy Expenditure	854
6	Absolute Oxygen Consumption during the total time of constant-power muscular work	827
7	Product of the Load Power of the Last Stage and the Execution Time	827
8	Specific Oxygen consumption during the time of Constant-Power Muscular Work	816
9	Total aerobic energy expenditure absolute	707
10	Volume of performed Muscular Work	686
11	Percentage contribution of total anaerobic energy expenditure	240
12	Total Specific anaerobic energy expenditure	233
13	Percentage contribution of total aerobic energy expenditure	230

Therefore, it is not surprising that physical performance continues to be equated with maximum oxygen consumption. However, the appropriate selection of research methods and assessment criteria that most fully reflect the level of physical performance can only be determined through so-called factor analysis. When factoring 15- to 40-order correlation matrices using the principal component analysis with rotation of the reference axes using the Varimax criterion, we typically identified six to nine factors. The factor analysis model we used distinguishes factors in order of decreasing contribution to the overall sample variance. Therefore, the first factor was considered the general factor.

Research results. In the examined children of primary school age, the general factor was interpreted as metabolic capacity, as it characterises the volume of the substrate available for use and the permissible volume of changes in energy metabolism during intense muscular work of constant intensity. After one-factor analysis of variance, 13 indicators were separated, characterizing the total energy expenditure and oxygen exchange during specially organized muscular activity under bicycle ergometry conditions with a load intensity at the level of individual VO2 max values (Table 1).

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Conclusion. Thus, the data obtained indicate the necessity of incorporating into the physical training of primary school children methods and tools aimed at improving the efficiency of aerobic energy production, as an integral part of the internal structure of children's preparedness for strenuous muscular activity. Factor analysis revealed that the aerobic abilities of primary school children have a heterogeneous structure and are largely determined by capacity, power, the feasibility of potential aerobic power, and aerobic efficiency.

დაწყებითი სკოლის ასაკის ბავშვების ფიზიკური მაჩვენებლები და ბიოლოგიური სიმწიფე

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აბსტრაქტი
ერთფაქტორიანი დისპერსიული ანალიზის შედეგები მიუთითებს დაწყებითი სკოლის ასაკის ბავშვების ფიზიკურ მომზადებაში აერობული ენერგიის წარმოების ეფექტურობის გაუმჯობესებისკენ მიმართული მეთოდებისა და ინსტრუმენტების ჩართვის აუცილებლობაზე, როგორც ბავშვების ინტენსიური კუნთოვანი აქტივობისთვის მზადყოფნის შიდა სტრუქტურის განუყოფელ ნაწილად. ფაქტორულმა ანალიზმა აჩვენა, რომ დაწყებითი სკოლის ასაკის ბავშვების აერობულ შესაძლებლობებს აქვთ
DOI: 10.56580/GEOMEDI70
ჰეტეროგენული სტრუქტურა და ისინი დიდწილად განისაზღვრება გამძლე-ობით, სიმძლავრით, პოტენციური აერობული ძალის გონივრული მოხმარებით და აერობული ეფექტურობით.

საკვანძო სიტყვები: დისპერსიული ანალიზი, დინამიური რეჟიმი, კუნთოვანი მუშაობა, აერობული შესაძლებლობები.

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