

В результате обработки и анализа полученной информации 95% респондентов подтвердили мнение о том, что внедрения в образовательный процесс по физической культуре в школе новых педагогических технологий позволят повысить качество преподавания.

**Заключение.** Модуль – это целевой функциональный узел, в котором объединены учебное содержание, и технология овладения им. Содержание обучения представляется в законченных самостоятельных комплексах (информационных блоках), усвоение которых осуществляется в соответствии с целью. Дидактическая цель формулируется для обучаемого и содержит в себе не только указания на объем знаний, но и на уровень его усвоения.

В целом, применение модульно-рейтинговой технологии на уроках физкультуры, позволит, на наш взгляд, достичь следующих положительных моментов:

1. Не наносить психологического вреда учащемуся в связи с выставлением отрицательной оценки.

2. Дифференцировать подход к ученику, т. е. того, что каждая секунда, каждый сантиметр оценивается.

3. Учащиеся, не пропустившие ни одного урока, получают бонусные баллы.

4. Поощряется участие в соревнованиях за сборную школы.

5. Создаётся благоприятная обстановка для здоровой конкуренции на уроках.

Все указанные составляющие, несомненно, позволят в итоге достичь основной цели учебной программы «Физическая культура и здоровье» – обеспечить совершенствование получения базового физкультурного образования, а значит, в перспективе, способствовать дальнейшей жизнедеятельности здорового и гармонично развивающегося общества.

#### Литература

1. Беспалько, В.П. Педагогика и прогрессивные технологии обучения / В.П. Беспалько. – М.: Просвещение, 1995. – 143 с.
2. Вашина, К. Я. Саморазвитие человека и модульное обучение. / К. Я. Вашина. – Новосибирск: Просвещение, 2001. – 324 с.
3. Голощёкина, Л. П., Збаровский, В. С. Модульная технология обучения: Методические рекомендации. / Л. П. Голощёкина, В. С. Збаровский. – СПб: ЮНИТИ-ДАНА, 1993. – 135 с.
4. Домашева, О. С. Теория и практика модульного обучения. / О. С. Домашева. – М.: МСГИ, 2012. – 168 с.
5. Кашлев, С. С. Технология интерактивного обучения / С. С. Кашлев. – Мн.: Белорусский верасень, 2005. – 195 с.
6. Ксензова, Г. Ю. Перспективные школьные технологии: учебно-метод. пособие – 2-е изд., доп. и перераб. / Г. Ю. Ксензова. – М.: МСГИ, 2013. – 224 с.

УДК 796.41: 796.011.1–053.66.

### THE IMPORTANCE OF AEROBIC EXERCISE IN ADOLESCENT PHYSICAL EDUCATION: CULTIVATING HEALTH, COGNITION AND LIFELONG WELL-BEING

**Jing Tao, V.V. Yanovskaya**

*Vitebsk State University named after P.M. Masharov, Republic of Belarus*

e-mail: viktoriyayanovskaya2021@gmail.com

**Abstract.** Structured, regular aerobic activity is a fundamental factor in the holistic development of adolescents. Aerobic exercise has multifaceted benefits including profound positive effects on physical health, cognitive and academic abilities, as well as mental and psychosocial well-being. There are also modern problems that hinder adequate aerobic activity, such as a sedentary lifestyle, academic workload, and inadequate physical education programs. But there are ways to integrate aerobics programs into standard physical education.

**Keywords:** aerobic exercise, adolescent health, physical education, cognitive development, mental health, obesity prevention.

# ЗНАЧЕНИЕ АЭРОБНЫХ УПРАЖНЕНИЙ В ФИЗИЧЕСКОМ ВОСПИТАНИИ ПОДРОСТКОВ: РАЗВИТИЕ ЗДОРОВЬЯ, ПОЗНАВАТЕЛЬНЫХ СПОСОБНОСТЕЙ И БЛАГОПОЛУЧИЯ НА ПРОТЯЖЕНИИ ВСЕЙ ЖИЗНИ

Цзинь Тао, В.В. Яновская

*Витебский государственный университет имени П.М. Машерова, Республика Беларусь*

**Аннотация.** Структурированная, регулярная аэробная активность является основополагающим фактором целостного развития подростков. У аэробных упражнений есть многогранные преимущества включая глубокое положительное влияние на физическое здоровье, когнитивные и академические способности, а также психическое и психосоциальное благополучие. Существуют и современные проблемы, препятствующие адекватной аэробной активности, такие как малоподвижный образ жизни, академическая нагрузка и неадекватные программы по физкультуре. Но существуют способы интеграции программ аэробики в стандартное физическое воспитание.

**Ключевые слова:** аэробные упражнения, здоровье подростков, физическое воспитание, когнитивное развитие, психическое здоровье, профилактика ожирения.

Adolescence, the developmental stage between childhood and adulthood, represents a period of unprecedented physical, psychological, and social transformation. It is a critical window of opportunity for establishing behaviors and habits that will dictate health trajectories throughout an individual's life. Concurrently, this period is marked by new vulnerabilities, including the onset of mental health issues, increased risk of sedentary behaviors, and the development of lifestyle-related chronic diseases. In this context, the role of a robust and thoughtfully designed physical education (PE) system becomes paramount.

Historically, physical education has often been marginalized within the broader academic curriculum, perceived as a less serious subject focused primarily on sports skills, competition, and mere physical recreation. However, a modern, evidence-based understanding positions PE as a vital component of public health and education strategy. At the heart of this reformed view is aerobic exercise – a form of continuous, rhythmic physical activity that elevates the heart rate and improves the body's consumption of oxygen. Activities such as running, swimming, cycling, brisk walking, and dancing are classic examples.

The premise of this paper is that structured aerobic exercise must be the cornerstone of any effective adolescent physical education program. Its importance transcends simple physical fitness; it is a potent, non-pharmacological intervention that simultaneously addresses multiple challenges of modern adolescence. This essay will explore the scientific evidence supporting the indispensable role of aerobic exercise in fostering physical health, enhancing cognitive and academic capabilities, and promoting mental and emotional resilience. It will also confront the significant barriers to its implementation and propose a comprehensive model for integrating impactful aerobic training into school-based physical education, aiming to empower adolescents with the knowledge and motivation for a lifetime of healthy activity.

*The purpose of the study* is to analyze the literature data and our own research confirming the indispensable role of aerobic exercise in strengthening physical health, improving cognitive and academic abilities, as well as in increasing mental and emotional stability.

**Material and methods.** In this study, literature analysis was used to systematically review academic papers, experimental reports and case studies.

**Results and their discussion.** Aerobic exercise – this process involves the circulatory and respiratory systems working in concert to supply oxygen to working muscles over an extended period. The intensity is typically moderate to vigorous, often measured by a heart rate between 60% and 85% of an individual's maximum heart rate. Key characteristics include: duration: Typically sustained for a minimum of 10-20 minutes continuously, though longer durations yield greater benefits; intensity: Moderate (e.g., brisk walking, cycling on flat ground) to vigorous (e.g., running, swimming laps); rhythmic Nature: Involves repetitive movements.

During aerobic activity, the body's demand for energy increases. To meet this demand, the heart beats faster to pump more oxygen-rich blood to the muscles. The lungs work harder to take in more oxygen and expel carbon dioxide. Inside the muscle cells, mitochondria (the cellular “powerhouses”)

utilize this oxygen to convert stored carbohydrates and fats into adenosine triphosphate (ATP), the primary energy currency of the cell. Regular aerobic training induces a suite of physiological adaptations known as improved aerobic capacity or cardiorespiratory fitness (CRF), measurable as  $\text{VO}_2 \text{ max}$  (maximum oxygen consumption). These adaptations include: cardiac Output: The heart muscle becomes stronger and more efficient, pumping more blood with each beat (increased stroke volume); capillarization: The number of tiny blood vessels (capillaries) in the muscles increases, improving oxygen delivery and waste removal; mitochondrial Density: The number and efficiency of mitochondria within muscle cells increase, enhancing the muscles' ability to produce energy aerobically; metabolic Efficiency: The body becomes better at utilizing fat as a fuel source and managing blood glucose levels. This increased efficiency is a fundamental factor providing a wide range of health benefits.

The surge in sedentary behaviors, driven by increased screen time and passive entertainment, coupled with the widespread availability of energy-dense, nutrient-poor foods, has created a global health crisis among youth. Aerobic exercise serves as a powerful antidote to these trends.

Childhood and adolescent obesity is a primary predictor of adult obesity and is linked to a host of comorbidities. Aerobic exercise is a cornerstone of weight management due to its high energy cost. It creates a significant caloric deficit, helping to maintain a healthy energy balance. Regular participation increases resting metabolic rate and promotes a favorable body composition by reducing adipose tissue (body fat) while preserving lean muscle mass. School-based PE programs that consistently incorporate moderate-to-vigorous aerobic activity have been shown to significantly reduce Body Mass Index (BMI) percentiles and body fat percentage in adolescents [2, 3].

Strengthening the Cardiometabolic System – the benefits extend far beyond weight. Regular aerobic activity is one of the most effective ways to improve cardiovascular health: heart Strength: It strengthens the heart muscle, reducing resting heart rate and blood pressure; lipid Profile: It improves blood lipid levels by increasing high-density lipoprotein (HDL – «good» cholesterol) and decreasing triglycerides and low-density lipoprotein (LDL – «bad» cholesterol); insulin Sensitivity: It enhances the body's sensitivity to insulin, playing a crucial role in preventing and managing Type 2 Diabetes Mellitus. Studies consistently show that adolescents with higher levels of aerobic fitness have a more favorable cardiometabolic risk profile, which tracks strongly into adulthood [3,4].

Building Strong Bones and Muscles While weight-bearing exercises are often highlighted for bone health, aerobic activities like running, jumping rope, and certain sports also impose beneficial stress on the skeletal system. This stimulus promotes bone mineralization and density during the critical adolescent years, a key period for achieving peak bone mass. This provides a crucial buffer against osteoporosis and fractures later in life. Furthermore, aerobic exercise improves overall muscular endurance and functional capacity [4].

Establishing Lifelong Healthy Habits Perhaps most importantly, adolescence is a formative period for habit formation. Positive experiences with aerobic exercise in PE can lead to the internalization of physical activity as a regular part of daily life. An adolescent who enjoys running, dancing, or swimming is more likely to continue these activities as an adult, reaping the long-term benefits of reduced risks for coronary heart disease, stroke, certain cancers, and all-cause mortality.

Enhancing the Mind: The Cognitive and Academic Benefits. The adage «a healthy body houses a healthy mind» is strongly supported by neuroscience. The impact of aerobic exercise on the brain is profound, making it highly relevant to the core academic mission of schools.

Neurobiological Mechanisms Aerobic exercise induces several direct changes in the brain:

- increased Brain-Derived Neurotrophic Factor (BDNF): Often described as «fertilizer for the brain,» BDNF supports the survival of existing neurons and encourages the growth and differentiation of new neurons and synapses. It is crucial for learning and memory [1];
- enhanced Cerebral Blood Flow: Exercise increases blood flow to the brain, delivering more oxygen and nutrients essential for optimal function;
- neurogenesis: It promotes the creation of new neurons, particularly in the hippocampus, a brain region vital for memory and learning [1,5];
- modulation of Neurotransmitters: It balances key neurotransmitters like dopamine, norepinephrine, and serotonin, which regulate attention, motivation, arousal, and mood.

Impact on Cognitive Functions These physiological changes translate into tangible cognitive benefits for students:

- executive Function: This includes skills like working memory (holding and manipulating information), cognitive flexibility (switching between tasks), and inhibitory control (resisting distractions and impulses). These are precisely the skills required for academic success and are significantly enhanced by regular aerobic exercise [5];

- attention and Concentration: Studies show that a single session of aerobic activity can improve attention and focus immediately afterward. Longer-term participation leads to sustained improvements, which is particularly beneficial for adolescents with Attention-Deficit/Hyperactivity Disorder (ADHD);

- memory and Learning: The hippocampal growth stimulated by exercise directly enhances memory consolidation and retrieval, making studying more effective.

Academic Performance A compelling body of evidence now links higher levels of physical fitness, particularly aerobic fitness, to improved academic achievement. Meta-analyses have found that students who participate in regular physical activity, including aerobic PE classes, tend to have better grades and higher standardized test scores in core subjects like math and reading. Importantly, time taken from academic classes for PE does not harm achievement; rather, the enhanced cognitive function often leads to more efficient learning, effectively making the remaining academic time more productive.

The Mental and Psychosocial Sanctuary: adolescence is notoriously a time of emotional turbulence, identity formation, and social pressure. Rates of anxiety, depression, and stress are climbing alarmingly. Aerobic exercise provides a powerful, accessible, and cost-effective buffer against these challenges.

The psychological benefits are mediated through multiple pathways:

- endorphin Release: Aerobic exercise triggers the release of endorphins, neurochemicals that produce analgesia and feelings of well-being (often called the “runner's high”);

- reduction of Stress Hormones: It lowers the body's stress hormones, such as cortisol and adrenaline;

- meditative Effect: The rhythmic, repetitive nature of activities like running or swimming can induce a state of mindfulness, providing a mental break from worries and ruminative thoughts;

- behavioral Activation: For those experiencing depression, exercise serves as a positive, goal-oriented behavior that counteracts withdrawal and inactivity.

School-based aerobic programs have been demonstrated to reduce symptoms of depression and anxiety and improve overall mood states in adolescents.

Boosting Self-Esteem and Body Image Mastering physical challenges – running a farther distance, improving one's time, mastering a new dance routine – fosters a sense of competence and achievement. This success builds self-confidence and self-efficacy, the belief in one's ability to succeed, which can generalize to other life domains. Furthermore, as body composition improves and fitness increases, body image often becomes more positive, which is crucial during a life stage preoccupied with physical appearance.

Fostering Social Connection and Skills While often an individual pursuit, aerobic exercise in a PE setting is inherently social. Team-based aerobic games, group runs, or dance classes provide opportunities for socialization, cooperation, and the development of teamwork and communication skills. They create a sense of shared purpose and community, combating loneliness and social isolation. For many adolescents, the PE class and sports teams are primary venues for building friendships and a sense of belonging.

Despite the overwhelming evidence, integrating sufficient, high-quality aerobic exercise into school PE faces significant obstacles:

- academic Pressure and Curriculum Crowding: An intensified focus on standardized testing and core academic subjects has often led to the reduction or elimination of PE time and recess.

- inadequate Resources: Many schools suffer from a lack of facilities (e.g., gymnasiums, tracks, pools), outdated equipment, and large class sizes, making individualized attention difficult.

- quality of PE Instruction: Traditional PE curricula often overemphasize competitive sports, which can alienate less athletic students. A «roll out the ball» approach, where students are simply given equipment with little instruction, fails to provide the structured, moderate-to-vigorous activity required for aerobic benefit.

- the Sedentary Digital Environment: smartphones, video games, and streaming services present highly engaging competition for adolescents' leisure time.

- lack of Student Motivation: Negative past experiences, self-consciousness, and a lack of perceived competence can lead to disengagement and avoidance of PE class.

To overcome these barriers, a deliberate and modernized approach is required. The goal is to create a positive, inclusive, and effective aerobic experience for every student.

For example, at the level of curriculum and pedagogy:

- focus on Health-Related Fitness: Shift the focus from sports performance and winning to personal improvement and health-related fitness goals (e.g., improving one's mile run time, increasing heart rate monitoring).

- use of Technology: Incorporate heart rate monitors, fitness trackers, and apps to make feedback immediate, personal, and engaging. Gamification can increase motivation.

- offer Variety and Choice: Not every student enjoys running. Offer a diverse range of aerobic activities throughout the year: dance (Zumba, hip-hop), cycling, swimming, circuit training, martial arts, and ultimate frisbee. This helps cater to different interests and prevents boredom.

- differentiated Instruction: Design activities that allow students to work at their own ability level. Use pacing groups, provide modifications for intensity, and set personal goals rather than uniform standards for all.

- education and Empowerment: Integrate lessons on the why – the science behind the benefits. An educated student is a more motivated participant.

Creating a supportive environment through the following means:

- emphasize Inclusion and Mastery, Not Competition: Foster a climate where effort and personal progress are celebrated over being the fastest or the best.

- positive Reinforcement: PE teachers should be trained as encouragers and facilitators, not just coaches for the talented few. Their role is critical in shaping attitudes.

- ensure Safety and Inclusivity: Provide appropriate attire and facilities that respect students' privacy and comfort. Implement anti-bullying policies strictly.

Equally important is the structurality and political support that is provided through:

- mandate Minimum Time Requirements: Advocate for policies that require daily, quality PE with at least 50% of class time spent in moderate-to-vigorous physical activity (MVPA).

- professional Development: Invest in ongoing training for PE teachers on the latest evidence-based practices for teaching aerobic activities and promoting lifelong fitness.

- community Partnerships: Utilize local parks, pools, and community centers to extend opportunities beyond the school walls.

**Conclusion.** The evidence is unequivocal: aerobic exercise is not a mere diversion but a fundamental necessity for the holistic development of adolescents. Its importance within physical education cannot be overstated. It is a unique intervention that simultaneously acts as a prophylactic against chronic physical disease, a catalyst for cognitive enhancement and academic achievement, and a stabilizer for mental and emotional well-being.

The challenges of the digital age and the escalating pressures on young people make the integration of robust aerobic programs more urgent than ever. Schools and physical educators hold a unique position of influence. By moving beyond outdated models and embracing a modern, evidence-based, and inclusive approach to aerobic exercise, they can do more than just teach sports; they can fundamentally improve the life course of their students. Investing in the aerobic fitness of the youth is an investment in a healthier, sharper, and more resilient future generation. The mandate for educators and policymakers is clear: to place aerobic exercise at the heart of physical education, equipping every adolescent with the foundation for a long, healthy, and fulfilling life.

## References

1. Hillman, C. H., Erickson, K. I., & Kramer, A. F. (2008). Be smart, exercise your heart: exercise effects on brain and cognition. *Nature Reviews Neuroscience*, 9(1), 58–65.
2. Janssen, I., & LeBlanc, A. G. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity*, 7(1), 40.
3. Ortega, F. B., Ruiz, J. R., Castillo, M. J., & Sjöström, M. (2008). Physical fitness in childhood and adolescence: a powerful marker of health. *International Journal of Obesity*, 32(1), 1–11.
4. Strong, W. B., Malina, R. M., Blimkie, C. J., et al. (2005). Evidence based physical activity for school-age youth. *The Journal of Pediatrics*, 146(6), 732–737.
5. Tomporowski, P. D., Davis, C. L., Miller, P. H., & Naglieri, J. A. (2008). Exercise and Children's Intelligence, Cognition, and Academic Achievement. *Educational Psychology Review*, 20(2), 111–131.