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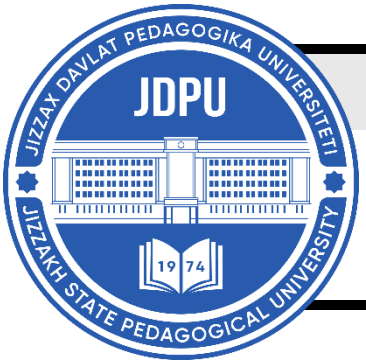

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METHODS OF COMPREHENSIVE APPLICATION OF SPECIAL PHYSICAL EDUCATION EXERCISES FOR OVERWEIGHT CHILDREN

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ABOUT ARTICLE

Key words: Overweight children; childhood obesity; physical education; special exercise program; intervention; physical fitness; high-intensity interval training; school health.

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Abstract: Overweight children in schools require specialized physical exercise approaches to effectively manage weight and improve fitness. This article presents a study based on a dissertation that developed and tested a comprehensive exercise program for overweight schoolchildren. A 12-week intervention integrated into physical education classes (with 40 children aged 11–15) and a 10-week after-school exercise program (with 30 children aged 10–14) were implemented. The program combined functional (strength) and aerobic exercises with game-based interval training tailored to the children's age and needs.

Introduction. The prevalence of childhood overweight and obesity has been rising sharply worldwide and is now recognized as a serious public health issue. According to the World Health Organization (WHO), the proportion of children and adolescents aged 5–19 classified as obese increased from about 4% in 1975 to over 18% by 2022. This means that globally, childhood obesity has more than quadrupled in the past few decades. Such excess weight in childhood is associated with numerous adverse health effects – including higher risks of cardiovascular diseases, type 2 diabetes, orthopedic problems, and even certain cancers – as well as psychosocial issues like low self-esteem and social stigma. Consequently, many countries have launched special programs to combat childhood obesity by increasing children's physical activity in school settings. For example, Japan integrated additional physical exercise

sessions into school curricula and achieved a significant reduction in obesity rates among students; Finland implemented daily active recess and outdoor activities; and the United States introduced programs such as the "Let's Move" campaign that promote physical activity through playful, competitive exercises. However, most existing school fitness programs are designed for general physical development and do not fully address the specific needs of overweight children. Studies indicate that for children with excess weight, a specially adapted exercise regime yields better outcomes in reducing body fat and improving fitness compared to a one-size-fits-all approach.

In Uzbekistan, as in many other countries, the issue of childhood overweight is becoming increasingly prevalent in recent years. National health statistics suggest that approximately 10–12% of school-age children in Uzbekistan are overweight or obese. Despite physical education being a required part of the school curriculum, current school PE classes (typically about 2 sessions per week) account for only an estimated 11% of children's recommended weekly physical activity. Moreover, a large proportion of overweight children do not engage in any extracurricular exercise: a baseline survey in our study found that nearly 30% of overweight students participated in no additional physical activity outside of regular PE classes, and only about 45% exercised more than once a week. These factors contribute to a continued positive energy balance and weight gain, exacerbating health risks. Many schools also face infrastructure limitations and lack specialized programs, which further hinder effective support for overweight students. There is therefore an urgent need for a tailored physical exercise system in general schools that takes into account local conditions and student characteristics. This study aims to develop and validate methodological approaches to improve the effectiveness of physical education for overweight schoolchildren by implementing a special exercise system within the school setting. The proposed system emphasizes an individualized approach, motivational support, and incorporation of modern technology, and is designed to align with children's age-specific capabilities and needs. We hypothesized that a comprehensive program of aerobic and strength exercises, applied in a structured way both during and after school, would lead to significant improvements in overweight students' physical fitness and a reduction in their excess body weight.

Methods. Participants and Baseline Assessment: The study was conducted in Andijan region with a preliminary assessment of 789 students (ages 7–16) across several schools. This initial screening identified that 30.3% of the children had overweight (above normal weight but not obese) and an additional 4.4% were classified as obese, with the prevalence of excess weight increasing in higher grade levels. Among the 274 students with overweight or obesity,

30.7% reported engaging in no extracurricular physical activity, 24.5% exercised only once per week, and about 44.8% exercised twice weekly. These baseline data confirmed the extent of insufficient physical activity in overweight students. All participants underwent baseline measurements including anthropometric indices (height, weight, body mass index – BMI, and waist circumference), cardiovascular fitness tests (e.g., a 6-minute walk test and Harvard step test for recovery heart rate), muscular strength/endurance tests (such as timed push-ups and sit-ups), and flexibility tests (sit-and-reach). For the intervention, 70 overweight students (approximately ages 10–15) were selected from the pool and randomly assigned to either an experimental group or a control group of equal size (each 35). Both groups continued to attend the standard school physical education classes (held twice a week for 45 minutes). The experimental group additionally participated in a specially designed exercise program for 12 weeks, whereas the control group followed only the regular curriculum without any supplemental exercises. The special program for the experimental group was implemented through a combination of integrated PE class sessions and extracurricular sessions. Specifically, students in the experimental group received an extra high-intensity activity session during one of their weekly PE classes (effectively introducing a third PE session per week) and also attended 1–2 after-school exercise club sessions per week (each ~60 minutes long). In total, the experimental group had 2–3 exercise sessions weekly (mix of curriculum and after-school), while the control group had the usual 2 sessions.

Intervention Program: The special exercise program was developed by combining aerobic exercises and functional strength exercises in an age-appropriate, game-enhanced format. For younger students (grades 1–4, roughly ages 7–10), a set of 5 aerobic and 9 strength exercises (referred to as a "5+9" exercise complex) was designed, focusing on fundamental movements and play to keep them engaged. For older students (grades 5–8, ages ~11–14), a similar exercise complex was tailored with progressively higher intensity. Each session began with a 10–15 minute warm-up, followed by ~25–30 minutes of a main exercise circuit, and ended with a 5–10 minute cool-down and stretching phase. We incorporated high-intensity interval training (HIIT) principles through game-based activities: short bursts of vigorous activity (such as shuttle runs, relay races, or tag games) were alternated with brief active recovery periods. Body-weight exercises (e.g., squats, modified push-ups, planks) were included to improve muscular strength and endurance. All exercises were demonstrated and performed under supervision, with an emphasis on correct technique and safety. The exercise intensity for each student was adjusted based on their ability; for example, heart rate and perceived exertion were monitored to ensure children were challenged yet not overstrained.

The program also emphasized enjoyment and motivation—students were frequently engaged in team activities and friendly competitions, and their progress was regularly encouraged and praised to build confidence.

Outcome Measures: Both groups were evaluated at baseline and post-intervention (after 12 weeks for the main school-based program, and additionally after 10 weeks for the supplemental club program). Key outcome measures included:

Body composition: body weight and BMI, and waist circumference.

Cardiorespiratory fitness: distance covered in the 6-minute walk test, performance on the Harvard step test (heart rate recovery index).

Muscular fitness: number of sit-ups in 60 seconds, number of push-ups (modified for girls) in 30 seconds, and plank hold duration.

Flexibility: sit-and-reach test result.

Motivation and activity level: a questionnaire assessed students' interest/enjoyment in PE and their extracurricular physical activity frequency; attendance records and qualitative feedback from students and parents were also collected.

All quantitative data were analyzed using appropriate statistical methods. Differences between the experimental and control groups were examined with Student's t-tests (independent and paired, as appropriate) with a significance threshold set at $p < 0.05$. This ensured we could determine whether any observed changes were statistically significant and not due to chance.

Results. At baseline, there were no statistically significant differences between the experimental and control groups in age, anthropometric measures, or fitness test results (all $p > 0.05$). This confirmed that the two groups were comparable at the start of the study. Over the course of the intervention, however, the experimental group showed notable improvements relative to the control group. Body Weight and Composition: After 12 weeks, students in the experimental group achieved an average body weight reduction of about 3.2% of their initial weight. In contrast, the control group students showed no significant change (in fact, some control participants gained a small amount of weight over the same period). The difference in weight change between the groups was statistically significant ($p<0.01$). For example, if the average baseline weight of the experimental group was ~50 kg, this corresponds to an average weight loss of ~1.5 kg, whereas controls remained roughly weight-stable. Similarly, the experimental group's average BMI decreased (improved) modestly, while the control group's BMI saw minimal change.

Cardiovascular Endurance: Performance on the 6-minute walk test improved substantially in the experimental group. The distance that experimental group children could walk/run in 6 minutes increased by roughly 18–20% on average from their baseline distance, indicating enhanced aerobic endurance. By comparison, the control group had only negligible changes in 6-minute walk distance. The experimental group also showed improved recovery on the Harvard step test: their post-exercise heart rates returned to normal more quickly, yielding better step test indices. For instance, the average distance in the 6-minute test for the experimental group increased from about 750 m to 900 m over the 12 weeks, whereas the control group remained around 760 m. These gains in endurance are important for overall cardiovascular health.

Muscular Strength and Endurance: The experimental group demonstrated significant gains in muscle strength/endurance measures. The average number of sit-ups completed in 1 minute by experimental students increased by about 15%, and the number of modified push-ups in 30 seconds increased by approximately 12%. In the plank hold test, some students who initially could only hold a plank for ~30 seconds were able to hold it for 45–60 seconds after training. In contrast, the control group's improvements on these muscle tests were minimal (typically less than 5% change, which was not statistically significant). These results suggest improved core and upper-body strength in the experimental group attributable to the strength exercises in the program.

Flexibility: Flexibility (sit-and-reach) scores in the experimental group improved slightly by the end of the program (several students increased their reach by 3–5 cm), likely due to regular stretching incorporated in each session. The control group's flexibility remained roughly unchanged. Although flexibility improvements were modest, maintaining or improving flexibility is beneficial for overall mobility and injury prevention.

Motivation and Physical Activity Level: One of the most notable outcomes was the positive change in attitude and motivation among the experimental group. Based on post-intervention surveys, the experimental group reported a roughly 40% increase in their enjoyment and interest in physical exercise and PE classes. Teachers also observed these students being more active and confident during PE lessons. Extracurricular physical activity levels rose as well: by the end of the program, about 70% of the experimental group students were engaging in some form of additional physical activity each week (up from ~55% at baseline), whereas the control group did not show such an increase. In quantitative terms, the experimental group's overall physical activity (including both PE classes and outside activities) increased by an estimated 25–30% versus baseline. Attendance in the optional after-school

sessions was high (over 90% of sessions attended on average), indicating good compliance. Parents of the experimental students also noted improvements: in informal feedback, many parents reported their children were more energetic, had improved mood and self-esteem, and were increasingly willing to be active (rather than sedentary) after participating in the program. Statistical analysis confirmed that the improvements observed in the experimental group were significant compared to the control group across key outcomes. Weight reduction, 6-minute walk distance, push-up and sit-up counts, and self-reported physical activity all showed statistically significant group-by-time interactions ($p<0.05$), favoring the intervention. The control group's small changes were within normal variation and not significant. Thus, the special exercise complex had a clear beneficial effect on the physical health and fitness of the participating overweight children.

Discussion. The findings of this study demonstrate that a comprehensive, tailored exercise program can effectively improve the health and fitness of overweight children in a school setting. Although a ~3% reduction in body weight over 3 months might seem modest, it is a meaningful change for children and indicates a reversal of the weight gain trend. Importantly, early intervention to reduce excess weight is critical, since overweight in childhood is likely to continue into adolescence and adulthood if left unaddressed. Even small improvements in weight and fitness at a young age can have long-term positive impacts on health trajectories. The intervention group's weight loss, coupled with fitness gains, suggests that the program not only stopped unhealthy weight gain but also initiated weight normalization and muscle development, which is a significant achievement in a relatively short period.

A key element of the program's success was the increase in overall physical activity frequency and intensity for the experimental group. By adding an extra session and incorporating vigorous interval exercises, we effectively raised the weekly activity level of these children. Prior research supports this approach: introducing additional PE lessons or active programs in schools has been shown to significantly boost children's total physical activity and improve health outcomes. For instance, one study found that 9-year-old children who participate in after-school sports clubs accumulated about 2,000–2,500 more steps per day and expended more calories than peers who do not, along with better cardiovascular indicators. This aligns with our observation that the experimental group had superior improvements in endurance and strength compared to the control. The inclusion of high-intensity interval training through play was likely a critical factor, as it efficiently improves aerobic capacity and can increase post-exercise metabolism, aiding weight management. Another critical aspect is

the age-appropriate and engaging nature of the exercise complex. We divided the program into lower-grade and upper-grade versions to ensure suitability for the children's developmental stages. Younger children responded well to game-like activities that made exercise fun, thereby improving their adherence and enthusiasm. Older children were able to handle more intense workouts and appreciated the challenge and variety. This tailored approach likely contributed to the remarkable increase in motivation and decrease in disciplinary issues noted by teachers (some reported that during the program, off-task behavior during PE classes dropped noticeably). Our results suggest that when exercises are adapted to children's needs and delivered in an enjoyable format, overweight children not only improve physically but also become more motivated to be active, creating a positive feedback loop. This is particularly important, as maintaining motivation is often a challenge in this population – many overweight youths feel self-conscious or discouraged in traditional PE settings. The supportive and inclusive nature of our program (which emphasized personal progress and team spirit over competition) likely helped build their self-confidence.

The social support from instructors and peers in the program is another point of discussion. Throughout the intervention, we fostered a supportive environment. The experimental group formed a camaraderie through shared activities, and they often encouraged each other. This social aspect can significantly impact children's willingness to participate. Overweight children sometimes face stigma; by creating a group where everyone was working toward similar health goals, we reduced any sense of isolation. Some parents even noted improvements in their child's social interactions and teamwork skills as a side benefit. From a practical standpoint, the program was implemented with minimal resources – using school facilities (classrooms, playgrounds, a basic sports hall) and simple equipment (balls, jump ropes, cones). This indicates that such interventions are feasible in resource-limited school environments, which is an important consideration for scaling up. The improved outcomes in our local schools have already drawn interest from other schools in the region, and the educational authorities have taken note of the positive changes.

Limitations and Future Directions: This study was limited to a relatively small sample and a specific region (Andijan). The duration was also limited to a few months; longer-term follow-up would be valuable to see if the benefits are sustained and if greater weight reductions occur with continued training. In future research, it would be useful to include dietary guidance alongside exercise, as a combined approach might yield even better results in weight management. We also acknowledge that our measures of physical activity and motivation relied partly on self-report and teacher observations; incorporating objective activity trackers or

psychological scales could provide more detailed insight. Despite these limitations, our study provides strong evidence that targeted physical activity interventions can be successfully integrated into school routines and can produce measurable health improvements in overweight children.

Implications: The positive results from this program support integrating similar special exercise modules into standard school physical education curricula for students who are overweight or obese. Schools should consider offering an additional PE session or an after-school fitness club focused on aerobic and strength exercises in an enjoyable format. Training school PE teachers to deliver such tailored programs is also important – they should be aware of how to modify exercises for different needs and how to keep students motivated. The study's approach is in line with global recommendations that children engage in at least 60 minutes of moderate-to-vigorous physical activity daily, which most current school schedules do not meet. Implementing our methods more broadly could help close this gap and foster healthier habits among youths. Ultimately, tackling childhood overweight through school-based programs contributes to preventing adult obesity and building a healthier society.

Conclusion. This research demonstrates that a comprehensive, special exercise complex can significantly benefit overweight school-aged children. The following key conclusions can be drawn: Effective Weight Management: The tailored physical exercise program led to an average body weight reduction of approximately 3% in 12 weeks among overweight children, while the control group saw no such improvement. This confirms the program's efficacy in helping manage and reduce excess weight in a short period. Improved Physical Fitness: Children in the experimental program showed substantial improvements in physical fitness parameters. Endurance (as measured by distance in the 6-minute walk) improved by about 20%, muscle strength/endurance (push-ups, sit-ups, plank time) increased by 10–30%, and flexibility was slightly enhanced, whereas the control group's fitness remained largely unchanged. This indicates the program successfully enhanced cardiovascular and muscular fitness in the target group. Higher Motivation and Participation: The special exercise complex significantly boosted students' motivation and engagement in physical activity. Overweight children who often were disengaged in regular PE became actively involved – evidenced by a ~40% increase in self-reported motivation and a marked rise in extracurricular activity participation in the experimental group. This suggests that the program not only improved fitness but also fostered a more positive attitude toward exercise, which is crucial for long-term adherence to a healthy lifestyle. Feasibility in School Settings: The intervention was implemented using existing school resources and within the school timetable (with minor

adjustments to include extra sessions). The success of the program in our pilot schools led to its adoption in real settings: for instance, the improved exercise regime was integrated into the physical education plan of School No. 35 in Andijan city after the study, resulting in an average 3.8% decrease in students' weight and a 20% improvement in their endurance over 12 weeks. Similarly, the after-school exercise complex was introduced at School No. 34 in Shakhrikhan district, yielding a 2.5% weight reduction and a 25% increase in activity levels among participants in 10 weeks. These implementations show that the program can be replicated and sustained in practice, amplifying its impact. In conclusion, integrating a specially designed exercise complex for overweight children within school programs is highly effective and recommended. Such initiatives help improve children's health indicators, encourage active lifestyles from an early age, and combat the growing issue of childhood obesity. Schools and policymakers should consider wide adoption of these methods, along with nutritional education and family involvement, to ensure a holistic approach to fostering a healthy, active younger generation.

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