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EXPERIMENTAL STUDY ON THE DEVELOPMENT OF STRENGTH THROUGH ATHLETICS-SPECIFIC METHODS IN PRIMARY SCHOOL STUDENTS

***Trofin Maria Mădălina Şuhani*[1]**
***Vizitiu Lakhdari Elena*[1*]**
"Ieremia Irimescu" High School, Brusturi[1]
maria.trofin92@yahoo.ro[1]
Interdisciplinary Research Center for Motor Sciences and Human Health, "Ștefan cel Mare" University of Suceava [1*]
elenav@usm.ro[1*]

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Abstract The study aimed to develop strength in 3rd and 4th grade students from the "Ieremia Irimescu" Junior High School in Brusturi. The research hypothesis assumed that the methods and means specific to athletics would be effective in improving strength, with progress becoming evident in the final testing. The research was conducted over the course of one school year, from September 2023 to June 2024, on a sample of 23 students from two classes. The initial testing was carried out in September, while the final testing took place within modules II, III and IV, following the implementation of the experimental intervention. For the development of strength, two training circuits and games, relays and applicative courses were applied that targeted all major muscle groups. One circuit was designed for individual execution, while the second involved exercises in pairs. The results showed that students in the experimental group achieved significant improvements in strength tests compared to the control group, which maintained their initial performance levels. The study confirms the effectiveness of athletics-specific methods, adapted to age, motor context and response to effort, highlighting the importance of well-structured and engaging physical activities in primary education.

Introduction

Strength represents the individual's ability to perform efforts of holding, overcoming, or yielding against an internal or external resistance, resulting from the contraction of one or more muscle groups [1]. In physical activities, two main forms of strength can be distinguished: general strength, which manifests in everyday activities, and specific strength, which occurs in motor actions performed within a particular type of activity [5]. The development of strength in children and adolescents is influenced by chronological age and gender, as well as by

morphological and functional characteristics. In prepubertal children, certain limitations in strength development are observed, while after puberty the progress of other motor qualities is more rapid than that of strength; girls generally reach approximately 75% of boys' performance levels [10]. There is a close relationship between psychomotor and morphofunctional traits, and neurological disorders can negatively affect motor development [14]. Between the ages of 7 and 10, the expansive character gradually diminishes, and individual interests and skills begin to correlate, with visible gender differences: girls tend to develop social awareness to a greater extent [13]. This stage is favorable for learning basic motor patterns and consolidating sport-specific motor skills, such as those required in swimming or gymnastics [11], while fundamental motor skills undergo continuous refinement [4]. Athletics provides numerous effective exercises for developing fundamental motor skills, such as strength and speed [12], as well as for achieving other training goals, including explosive speed, starting technique, jumping, and endurance [16]. Participation in athletics-specific exercises contributes to the development of motor strength and enriches research activities in the field of physical education and school sports [17]. Eight-week circuit training programs have demonstrated significant effects on cardiovascular endurance, muscular endurance, strength, flexibility and speed [3]. Athletics remains a central discipline in physical education, supporting the harmonious development of speed, endurance, strength, agility and coordination [15]. Modern sports science is actively reexamining traditional methodological approaches to the development of physical qualities [7]. In addition to increasing strength, exercise programs for children and adolescents also positively influence other components of health and fitness. Appropriate exercise improves strength, cardiorespiratory fitness, and body composition, thereby reducing cardiovascular risk [6].

Material-method

Research hypothesis: It is assumed that the selected athletics-specific means will be effective in developing the motor quality of strength, with students expected to demonstrate progress in the final testing. During this process, we took into account the students' age-related characteristics, their existing motor skills, and their response to physical effort. Study purpose: The purpose of this study is to develop motor strength in 3rd and 4th grade students from the "Ieremia Irimescu" Junior High School in Brusturi. Study objectives: The first objective is to achieve the purpose of the study, namely to optimize the motor strength of the students participating in the research. This will only be possible if the methods and means used are adequate. The development of motor strength in the subjects involved in the study will be monitored by quantifying the results obtained and by means of graphs that clearly and concisely present the results of the applied control tests. The second objective is to test the hypothesis of the study, namely to demonstrate the effectiveness of the methods specific to athletics in the development of motor strength. The methods and means

used must be adequate to ensure that, in the final testing, the progress of the subjects in the experimental group is evident. In this process, careful consideration will be given to the motor background of the students, their age-related characteristics and their response to effort. The third objective is to demonstrate that, in the final testing, the students in the control group will maintain their performance levels observed in the initial testing. Of course, there may be minor exceptions, which could manifest as normal regressions in some students due to the interruption of specific training and the development of certain morphological indices. Another factor influencing the performance of students is their health, which can be compromised during cold seasons due to common ailments. The fourth objective is to demonstrate that the experimental group will achieve visible progress compared to the control group. This will only be possible if the methods and means used are appropriate for the development of motor strength. Another decisive factor in the progress of students is the way in which these means are adapted to the level of the group, which can be achieved through the teacher's creativity to make the activities as engaging and attractive as possible. Research methods: Study of bibliographical materials; Pedagogical observation; Experimental method; Testing method; Statistical-mathematical method; Graphical method. Given the small number of students in primary school, the research was carried out on two primary classes, namely grades III and IV. Using the documentation method, a total of 23 students from these two classes were selected, consisting of 11 girls and 12 boys. The research was conducted during one school year, from September 2024 to June 2025. In the first module, September, the initial testing was carried out, while the final testing took place within modules II, III and IV, following the implementation of the experimental interventions.

Systematization and Description of the Means Used. For the development of strength, we chose to use two circuits and 26 games, relays, and application courses targeting all major muscle groups. The two circuits were designed as follows: one for individual execution by each student, and the other to be performed in pairs. The wide variety of games, relays, and application courses was selected from various books, articles, and online sources to ensure diversity, engagement, and effectiveness

Table 1 Physical Education Planning

Period	Learning Unit	Targeted Motor Skills	Content	Assessment
Sept.–Oct.	Initiation and Adaptation	Speed, Dexterity	Organization exercises; sprinting; movement games; general warm-up exercises	Initial
Nov.–Dec.	Motor Development	Strength, Mobility	Push-ups with support; frog jumps; trunk lifts; trunk extensions; indoor games	Formative

Period	Learning Unit	Targeted Motor Skills	Content	Assessment
Jan.–Feb.	Skill Consolidation	Strength, Coordination	Acrobatic gymnastics; strength circuits; mobility exercises; movement games	Formative
March	Athletics	Speed, Strength	Sprinting; long jump; throwing the oină ball; medicine ball throws	Intermediate
April	Sports Games	Dexterity, Endurance	Football: dribbling, passing, shooting; relays and application courses	Formative
May	General Physical Development	Strength, Endurance	Circuits 1 & 2; application courses; endurance games	Formative
June	Final Evaluation	All motor skills	Motor tests: push-ups, long jump, sprinting, trunk lifts	Final

Fig.1. Circuit example-picture generated with AI program

Instruction: Complete all 6 stations in order. Repeat 2–3 rounds. Rest 1 minute between rounds.

Table 2 – Examples of exercises, games, and circuits

Category	Purpose	Concrete Examples
Speed exercises	Developing reaction and movement speed	Running 20–30 m from various positions; quick starts on signal; running with changes of direction
Strength exercises	Developing muscular strength	Push-ups with support; squats; trunk lifts; trunk extensions
Mobility exercises	Increasing range of motion	Arm rotations; trunk bends and twists; lunges; stretching
Movement games (speed)	Developing reaction	"Traffic Light"; "Who Gets There First"
Movement games (skill)	Developing coordination	"Catch the Ball"; dribbling the ball through cones
Movement games (endurance)	Developing endurance	"Hunters and Rabbits"; "Chase"
Strength circuit no. 1	Developing general strength	Push-ups; squats; jumps; trunk lifts; running in place

Category	Purpose	Concrete Examples
Strength circuit no. 2	Developing strength and coordination	Lunges; frog jumps; trunk extensions; throws; application course
Application courses	Developing combined motor skills	Run → jump → crawl → throw at target; dribble ball → shoot

Results:

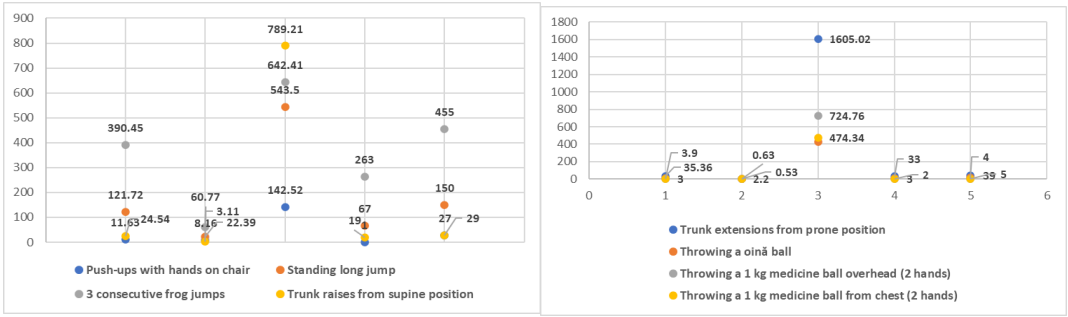

Fig.1 The values obtained by the girls from the control group during the initial testing of the applied control tests

The tests applied to the students show significant variations in strength and coordination between different muscle groups. The chair push-up test has an average of 11.63 repetitions (range 1–27), indicating large differences in arm and shoulder strength. The standing long jump has an average of 121.72 cm (range 67–150 cm), highlighting the variability of the explosive power of the lower limbs. The three consecutive jumps from the "frog" position have an average of 390.45 cm (range 263–455 cm), showing differences in leg coordination and strength. The trunk lift from a supine position has an average of 24.54 repetitions (range 19–29), and the trunk extension from a supine position has an average of 35.36 repetitions (range 33–39), indicating a relatively uniform performance in the trunk area. Throwing a 1 kg medicine ball overhead (3.9 m; 3–5 m) and from the chest (3 m; 2–4 m) demonstrates moderate strength and coordination, with differences between students. Overall, the results reflect variable development of strength and coordination depending on the muscle group involved.

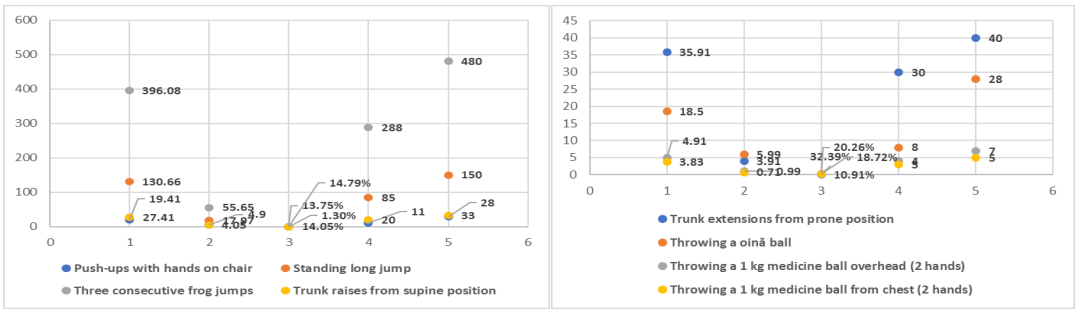

Fig.2 The values obtained by the boys from the control group during the initial testing of the applied control tests

The chair push-up test showed a mean of 19.41 repetitions (11–28), indicating relatively uniform arm and shoulder strength. The standing long jump averaged 130.66 cm (85–150 cm), demonstrating moderate variability in explosive leg strength. The three consecutive frog jumps averaged 396.08 cm (288–480 cm), reflecting good leg strength and coordination, with some variation between students. The supine trunk raise averaged 27.41 repetitions (20–33), and the supine trunk extension averaged 35.91 repetitions (30–40), demonstrating uniform trunk strength and endurance. The ball throw averaged 18.5 m (8–28), indicating greater variability in arm strength and coordination. The 1 kg medicine ball throw over the head averaged 4.91 m (4–7) and from the chest 3.83 m (3–5), demonstrating largely uniform arm strength with moderate differences between students. Overall, the results indicate good overall development of strength and coordination, with some variability depending on the muscle group tested.

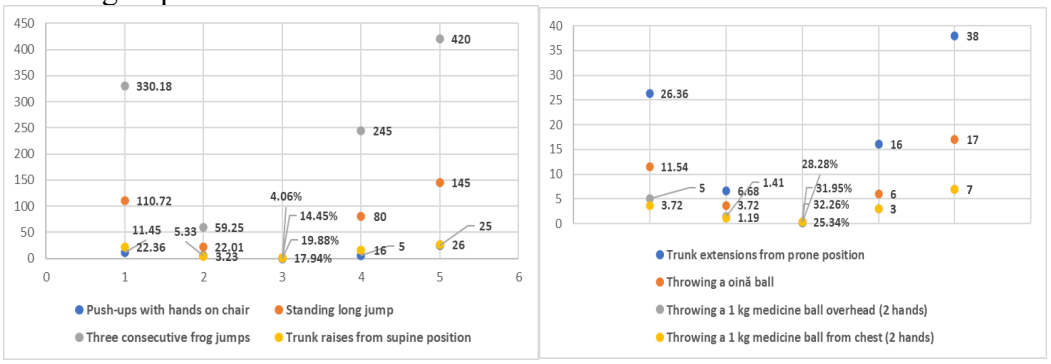

Fig.3 The values obtained by the girls from the experimental group during the initial testing of the applied control tests

The chair push-ups averaged 11.45 repetitions (5–25), demonstrating relatively uniform upper body strength. The standing long jump averaged 110.72 cm (80–145), indicating moderate variability in leg explosive strength. Three consecutive frog jumps averaged 330.18 cm (245–420), reflecting good leg strength and coordination, with some variation. The supine trunk raise averaged 22.36 repetitions (16–26), and the supine trunk extension averaged 26.36 repetitions (16–38), demonstrating fairly uniform abdominal muscle strength but greater variability in the back extensors. The shot put averaged 11.54 m (6–17), demonstrating notable differences in upper body strength and coordination. The 1 kg medicine ball overhead throw averaged 5 m (3–7), and the chest-level throw averaged 3.72 m (3–7), indicating largely uniform arm strength with moderate variability. Overall, students generally demonstrated good strength and coordination, with some differences depending on the muscle group tested.

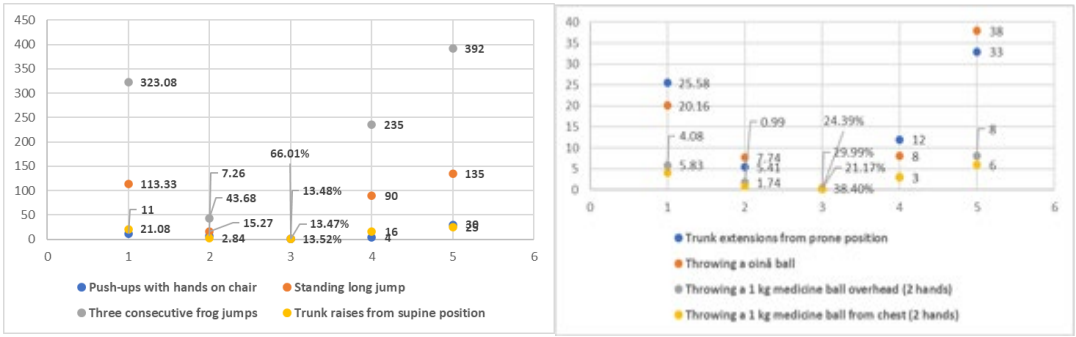

Fig. 4 The values obtained by the boys from the experimental group during the initial testing of the applied control tests

The chair push-up test averaged 11 repetitions (4–30), demonstrating high variability in arm and shoulder strength in girls. The standing long jump averaged 113.33 cm (90–135), with most performing near average, indicating fairly consistent explosive leg power. The three consecutive frog jumps averaged 323.08 cm (235–392), reflecting generally good leg strength and coordination, with moderate differences. The supine trunk raise averaged 21.08 repetitions (16–25), demonstrating less consistent trunk strength, while the supine trunk extensions averaged 25.58 repetitions (12–33), indicating greater variability in back strength. The ball throw with the oining had an average of 20.16 m (8–38), revealing large differences in arm strength and coordination. The 1 kg medicine ball overhead throw averaged 5.83 m (3–8) and the chest throw averaged 4.08 m (3–6), demonstrating largely uniform upper body strength with moderate variability. Overall, the results indicate good overall motor strength development, with notable differences between the strongest and weakest participants.

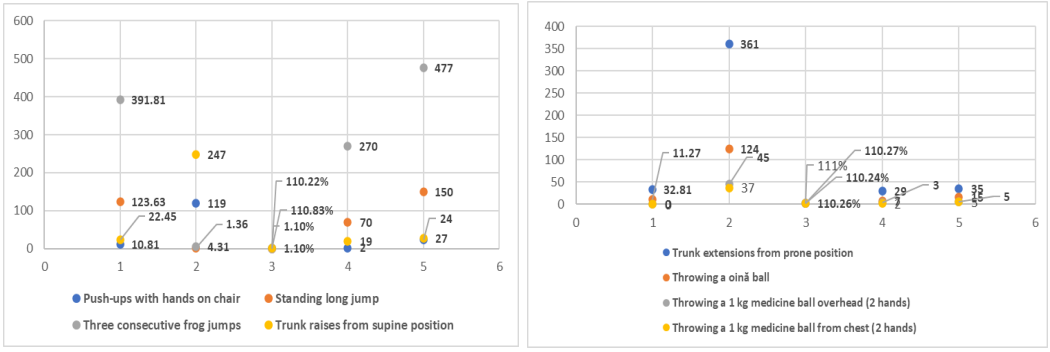

Fig.5 The values obtained by the girls from the control group during the final testing of the applied control tests

The chair push-up test averaged 10.81 repetitions (2–24), demonstrating moderate performance, with notable differences in arm and shoulder strength. The standing long jump averaged 123.63 cm (70–150), indicating generally good explosive leg strength with some variability. The three consecutive frog jumps averaged 391.81 cm

(270–477), reflecting good leg strength and coordination, although there were differences between stronger and weaker students. The supine trunk raise averaged 22.45 repetitions (19–27), demonstrating consistent lower trunk strength. The supine trunk extension averaged 32.81 repetitions (29–35), indicating consistent back muscle strength. The ball throw averaged 11.27 m (7–15), demonstrating moderate variability in arm strength and coordination. The 1 kg medicine ball overhead throw averaged 4.09 m (3–5), and the chest-level throw averaged 3.36 m (2–5), both demonstrating generally consistent upper body strength with moderate differences. Overall, students demonstrated good motor strength, with variability primarily in explosive power and throwing ability.

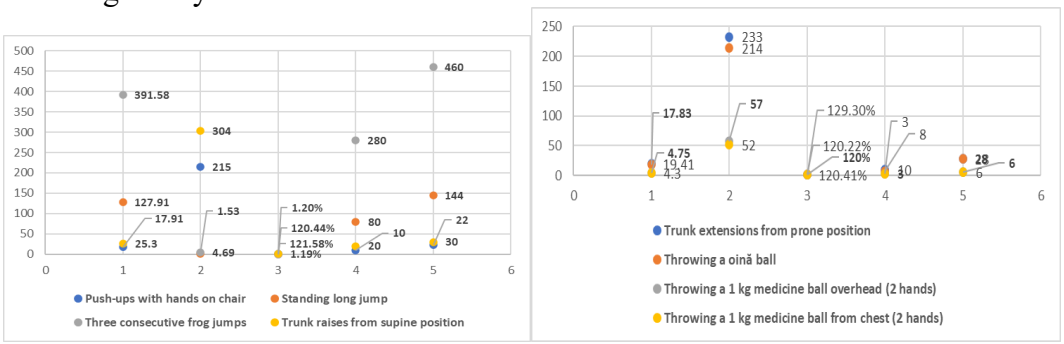

Fig.6 The values obtained by the boys from the control group during the final testing of the applied control tests

The bench press test averaged 17.91 repetitions (10–22), demonstrating good arm strength, with most girls nearing average. The standing long jump averaged 127.91 cm (80–144), indicating generally consistent explosive leg strength with some variation. The three consecutive breaststroke jumps averaged 391.58 cm (280–460), reflecting good leg strength and coordination, although there were differences between higher and lower performing students. The supine trunk raise averaged 25.3 repetitions (20–30), demonstrating solid lower body strength. Supine trunk extensions averaged 19.41 repetitions (10–28), indicating greater variability in back muscle strength. The ball throw averaged 17.83 m (8–28), highlighting differences in arm strength and coordination. The 1 kg medicine ball overhead throw averaged 4.75 m (3–6) and the chest throw averaged 4.3 m (3–6), both demonstrating generally consistent upper body strength with moderate variability. Overall, girls demonstrated good motor strength, with greater differences in back strength and throwing performance.

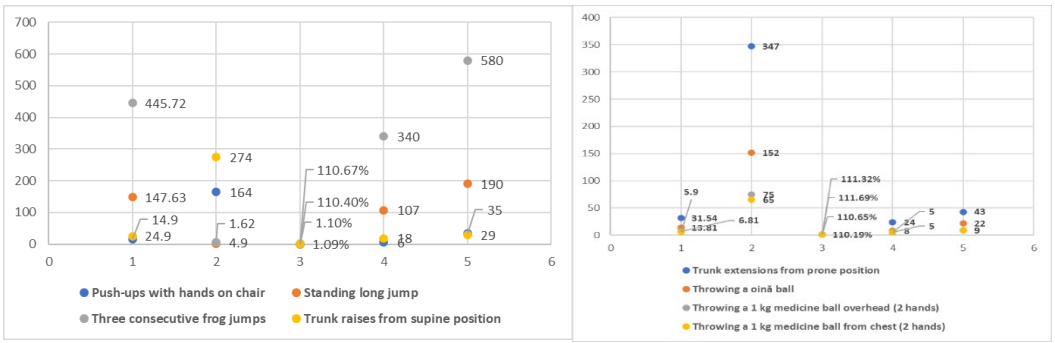

Fig. 7 The values obtained by the girls from the experimental group during the final testing of the applied control tests

The chair push-up test averaged 14.9 repetitions (6–35), demonstrating moderate to good arm strength, with high variability between students. The standing long jump averaged 147.63 cm (107–190), indicating good explosive leg strength, with most being close to average, but some much higher or lower. The three consecutive frog jumps averaged 445.72 cm (340–580), reflecting strong leg strength and coordination, although there were differences between the best and the weakest. The supine trunk raise averaged 24.9 repetitions (18–29), demonstrating generally good lower body strength. The supine trunk extension averaged 31.54 repetitions (24–43), indicating greater variability in back strength. The shot put averaged 13.81 m (8–22), demonstrating moderate differences in arm strength and coordination. The 1 kg medicine ball overhead throw averaged 6.81 m (5–9) and the chest throw averaged 5.9 m (5–9), both demonstrating generally consistent upper body strength and coordination. Overall, students demonstrated good motor strength, with greater variability in back and arm activities.

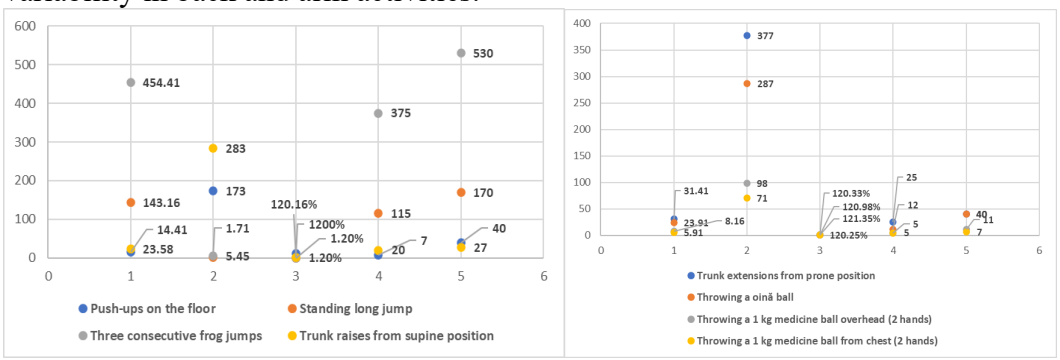

Fig.8 The values obtained by the boys from the experimental group during the final testing of the applied control tests

The push-up test averaged 14.41 repetitions (7–40), demonstrating moderate to good arm strength, with notable differences between participants. The standing long jump averaged 143.16 cm (115–170), indicating well-developed and fairly uniform leg power, with some outliers. The three consecutive frog jumps averaged 454.41 cm (375–530), reflecting good leg strength and coordination, although there

were differences between the strongest and weakest performers. The supine trunk raise averaged 23.58 repetitions (20–27), demonstrating uniform lower trunk strength. Supine trunk extensions averaged 31.41 repetitions (25–40), indicating moderate variability in back strength and endurance. The shot put averaged 23.91 m (12–40), demonstrating considerable differences in arm strength and coordination. The 1 kg medicine ball overhead throw averaged 8.16 m (5–11), and the chest-level throw averaged 5.91 m (5–7), both reflecting generally consistent upper body strength and coordination. Overall, participants demonstrated good motor strength, with greater variability in back-throwing activities.

Discussions

The study examined the effects of an 8-week FIT program on 4th-grade students (FIT n = 20; control n = 21). Strength and skill exercises, applied twice weekly for 15 minutes, significantly improved aerobic capacity, push-ups, flexibility, and jumping, with no injuries, demonstrating the benefits of integrating such exercises into physical education classes. [6]. The study found that the HIFT program significantly increased muscle mass and all strength test scores ($p < 0.01$). Significant interactions between HIFT and chronological age were observed for HGS and SBJ. Post hoc tests showed improvements in muscle mass and strength performance in all age groups, with the 18-year-old experimental group outperforming the control group on HGS and SU ($p < 0.01$). The school-based HIFT program is effective in increasing muscle mass and strength in adolescents, supporting the integration of bodyweight exercises into physical education classes. [8].

Conclusions

The data from the initial and final tests show that the applied methods and means contributed to the development of strength in the experimental group. Progress was evident in most of the control tests, including push-ups, deadlifts, jumps and throws, confirming that the main objective of the study was achieved. The use of exercises and methods specific to athletics has proven effective in developing the motor quality of strength. The improvements observed in the final tests of the experimental group, compared to their initial values and the control group, validate the hypothesis of the study. The control group generally maintained its initial performance, supporting the objective of demonstrating the stability of the results without the experimental program. Minor individual variations were observed, explained by factors such as interruptions in specific activities, changes in morphological indices or health status (illness, cold season), which are considered normal. The experimental group showed significant gains in most tests compared to the control group, demonstrating the effectiveness of the program. The adaptation of the exercises at the group level and the teacher's creativity contributed to motivating

the students and achieving visible progress, highlighting the importance of an engaging and adapted methodology. The students' progress was influenced by their initial motor skills, age, response to effort and health status. Personalized programs and varied methods were essential to maximize results and reduce differences between participants. The experimental program applied proved effective in developing strength in students, demonstrating that athletics-specific methods, creatively adapted, can ensure significant and uniform progress over time. Meanwhile, the control group maintained its performance, confirming the stability of the results without the specific program.

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