

A Comparative Study of Core Strength Training and Traditional Strength Training on the Physical Fitness Development of Elementary School Track and Field Athletes

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Abstract

This study investigates the impact of core strength training versus traditional strength training on the physical fitness development of Elementary School track and field athletes. With the increasing focus on quality-oriented education in Elementary Schools, track and field training has become essential for student skill mastery and physical development. Core strength training, in particular, is key to enhancing the effectiveness of such training. This study involved 20 Elementary School athletes (ages 9-11), divided into two groups: an experimental group using core strength training and a control group using traditional strength training. Over a 12-week period, both groups showed improvement in physical fitness indicators, but core strength training demonstrated more pronounced effects, particularly in increasing athletes' training interest and reducing sports injuries. However, its impact on certain fitness areas, like the standing long jump, was less significant, possibly due to poor muscle coordination and application. Additionally, the study revealed that many physical education teachers lacked sufficient knowledge and experience with core strength training. After the intervention, statistical analysis showed significant differences between the groups, with core strength training yielding more noticeable results in fitness development. Overall, while core strength training requires long-term commitment to yield optimal results, it offers considerable benefits over traditional methods, enhancing athletic performance, reducing injuries, and increasing motivation.

Keywords: core strength training; physical fitness development; traditional strength training; elementary school athletes

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Introduction

Exercise is an effective means of strengthening physical fitness, improving metabolism, and boosting immunity. Precisely because of these advantages, countries have prioritized sports and are gradually incorporating them into all levels of education. Track and field, a popular sport, is a popular and sought-after activity. It has also been gradually promoted and popularized in elementary school physical education. Track and field training provides crucial support for the development and improvement of elementary school students' physical fitness. However, the effectiveness of track and field training can be significantly reduced due to various factors. Core strength training is a key component of elementary school track and field training and plays a crucial role in improving performance. Therefore, teachers should prioritize core strength training, allowing students to fully utilize their core strength to further enhance the effectiveness of track and field training (Marta et al., 2019).

Track and field training in elementary school is a foundational stage for students' comprehensive physical development and a critical period for fostering the formation of various motor skills. Although core strength training is currently practiced in many sports, it has yet to be promoted and implemented in elementary school track and field training. A literature review revealed that most studies focus on the role of core strength training in developing specialized skills for elite and youth athletes, while studies examining the application of core strength training models in elementary school track and field training are limited. Therefore, this study employed literature review, questionnaire surveys, experimental methods, and mathematical statistics. Twenty athletes (aged 9-11) from Yijiang Primary School, Wuhu, were randomly divided into an experimental group (10 participants) and a control group (5 participants, 5 males and 5 females). Traditional strength training methods and simplified core strength training methods were used. Pre- and post-experimental data on five physical fitness indicators were compared and analyzed to explore the role of core strength training in developing athletes' physical fitness and athletic performance. This study, therefore, provides new perspectives on elementary school track and field training, offers basic training strategies and methods for frontline physical education teachers, and offers practical guidance for elementary school track and field training (Oliver et al., 2010).

Disadvantages of current core strength training in Elementary School track and field

Contents of core strength training for Elementary School track and field

Core strength training is a concept that was gradually introduced into physical training in the 1990s. It primarily involves effectively training the core muscle groups to ensure stability and coordination between various body parts during movement. Core strength training also further develops neural control and innervation, playing a key role in controlling the movement of the center of gravity, transmitting force to the upper and lower limbs, and stabilizing movement. Therefore, core strength training, as an important training program, plays a vital role in improving overall physical fitness, especially in elementary school, when students are in a crucial formative and developmental stage for motor function. Introducing core strength training not only effectively improves elementary school students' athletic ability but also promotes coordination and strengthens musculature. Therefore, we should prioritize and research core strength training in track and field, employing targeted training methods and utilizing scientific training equipment to promote high-quality and high-skill physical education in elementary schools (Stojanović et al., 2023).

Parents lack attention and cooperation

The reason why Elementary School track and field training is not very effective is largely related to the lack of attention and cooperation from parents. Most parents tend to think that track and field training has no practical effect and are unwilling to let their children spend time on training. They often pay more attention to participating in some interest classes other than track and field. Moreover, most students are not very involved and are unwilling to endure hardships, which makes it difficult to improve and enhance the effect of track and field training.

Elementary School students are not very interested in track and field training

Nowadays, with the continuous progress and development of the times, smart clients have been widely popularized in every household. More and more novel things have attracted the attention of Elementary School students, resulting in students spending their time only playing with their phones and lacking interest in track and field training. They are unwilling to take time out for track and field training. Due to the lack of interest of Elementary School students, the effectiveness of track and field training is low.

Track and field training poses certain risks

Any sport carries inherent risks, and track and field training is no exception. Without proper warm-up exercises, cramps and even sprains can easily occur during training. Elementary school students are in a prime period of physical and mental development, making them more susceptible to injury. Coupled with the fact that the safety and quality of sports equipment cannot be guaranteed, accidents can easily occur during track and field competitions (Septianto et al., 2024).

The Importance of Core Strength Training in Elementary School Track and Field Training

Core strength training, in simple terms, refers to stabilizing the human core and fully exerting the control and control over the nerves in order to exert muscle functionality, coordination, and the body's sensitivity. Core strength plays an important role in sports, especially in track and field training. It plays an important role in improving and enhancing the results of track and field training. Its important role is mainly reflected in the following aspects:

Enhance and improve body coordination

For elementary school track and field training, a student's coordination is a crucial factor directly impacting both the level and efficiency of training. Improving coordination is also a key and challenging aspect of track and field training. Core strength training can effectively improve core flexibility and agility, fostering greater coordination and flexibility between joints and limbs. This allows students to adjust their posture and maintain balance, enabling them to better participate in track and field training.

Improving the comprehensive sports ability of Elementary School students

Track and field training is a key component of elementary school physical education. Elementary school students are hyperactive and active, and many sports inherently involve running and jumping. Therefore, core strength training not only helps strengthen joint and muscle development but also enhances core muscle control, thereby strengthening overall athletic ability. Furthermore, core strength training in track and field can improve the coordination of upper and lower limb movements, enabling elementary school students to maintain stability during exercise and further enhance their overall athletic proficiency (Rico-Gonzalez, 2023).

Tempering and Training Elementary School Students ' Willpower

Track and field training places high demands on elementary school students' perseverance and endurance. Furthermore, track and field training is inherently tedious, making it difficult to persist without a strong will. Elementary school students are often drawn to novelty and are less likely to develop an interest in track and field training. Strengthening core strength training for elementary school students not only strengthens their physical functions but, most importantly, strengthens and cultivates their willpower. This can effectively foster a positive and healthy sportsmanship, enhance their influence on those around them, and provide a crucial guarantee for effective track and field training (Lasković et al., 2022).

Preventing Elementary School students from suffering sports injuries

Elementary school students' athletic abilities are still relatively weak, and their coordination and body control abilities are also weak. This is especially true during elementary school track and field training, where excessive movements or a lack of attention to safety often lead to unnecessary sports injuries. Therefore, strengthening core strength training in elementary school track and field not only helps elementary school students strengthen their body control, but also, for example, by strengthening their core strength and adjusting their body's center and posture in mid-air during hurdles, they can effectively avoid landing unstable and falling, thereby improving safety and preventing sports injuries.

1.2.5 is beneficial in improving the efficiency of track and field training and preventing sports injuries

Track and field training requires a lot of physical strength. Only by maintaining physical strength can the training efficiency be effectively improved. By strengthening the core strength training of Elementary School students, the body's regulatory ability and level can be improved, the waste of body energy can be avoided to the greatest extent, and efficient coordination between limbs can be ensured. In addition, through core strength training, the body control ability of Elementary School students can be improved, which can effectively prevent injuries in track and field training and ensure the safety of Elementary School students (Pržulj et al., 2022).

Basic principles of core strength training in elementary school track and field training

In order to effectively promote the effective training of students' core strength in elementary school track and field training, certain principles need to be followed. Only in this way can we ensure that elementary school students can train safely and effectively, and ensure the training effect of core strength, so as to better promote the improvement and enhancement of track and field training effects.

The principle of gradual progress

In fact, the training of core strength for Elementary School students in track and field training is a long-term task. Therefore, in order to ensure the effectiveness of training, it is necessary to formulate a long-term training plan, do a good job of planning, set expected training goals, and follow the principle of gradual progress. Combined with the physical fitness of Elementary School students and the track and field skills they have mastered, and combined with the growth patterns and needs of Elementary School students, formulate reasonable training content and plans, master the strength and intensity of training, and let every student experience a sense of accomplishment. Only in this way can students' training enthusiasm be improved, the effect of training can be guaranteed, and students' core strength can be effectively improved (Hardinata et al., 2024).

The principle of fun

Core strength training is a significant challenge for elementary school students. During the specific training process, teachers should focus on students' interests, shifting from traditional, single-minded training methods to a more engaging and engaging approach. This approach can increase student participation. During the specific training process, teachers should incorporate training content to increase the fun factor. For example, they can create game scenarios to stimulate student participation, alleviate students' anxiety about training, and ensure they can fully engage in the training.

Optimization principles

In elementary school track and field training, students vary significantly from person to person. Therefore, during core strength training, teachers should actively reflect on and optimize training. During specific training sessions, teachers need to reasonably evaluate the effectiveness of elementary school students' training and promptly identify any problems or deficiencies. By actively communicating with students, collecting their

opinions, and optimizing training content and plans, teachers can effectively enhance training results and achieve core strength training goals.

Application strategies of core strength training in Elementary School track and field training

Develop a detailed and comprehensive training plan

During the Elementary School track and field training, due to certain special characteristics of Elementary School students, their physical and mental development has not yet matured, and they find it difficult to withstand long-term and difficult training. Therefore, in the process of strengthening the core strength training of Elementary School students, it is necessary to comprehensively consider the physical and mental development laws and tolerance of Elementary School students, and formulate a more complete training plan to ensure that the core strength training of Elementary School students can be strengthened scientifically and effectively. First, conduct a comprehensive analysis of elementary school track and field training activities, analyzing and evaluating the age, physical function, and development of elementary school students at each stage. Training content and goals should be developed for different grades, and the goals should be refined to ensure targeted training. Most importantly, safety should be ensured, ensuring that elementary school students' core strength is effectively trained and improved. Second, teachers should use basic physical training to test and record elementary school students' core strength. A reasonable physical fitness database should also be developed to lay a good foundation for elementary school students' core strength training. Finally, a detailed core strength training plan should be implemented. Based on the actual needs of students, a reasonable weekly or monthly training plan can be developed, with different training content each day to specifically improve students' core strength in various parts of the body. For example, a weekly plan from Monday to Friday could include training in the following areas: standing knee raises, side-lying scissors kicks, Russian twists, side-lying hip raises, crunches, etc. This will improve the core strength of elementary school students in different parts of the body and cultivate their sportsmanship and qualities, enabling them to better participate in track and field training and effectively promote their physical fitness and various qualities during track and field training (Cocca et al., 2020).

Strengthen static core strength training

Static training is an important part of core strength training for Elementary School students. It is also an effective training method. It has a direct impact on the core strength training of Elementary School students and the improvement and enhancement of track

and field performance. Therefore, in the specific core strength training process, teachers should actively strengthen static core strength training to continuously strengthen Elementary School students' sense of balance and lay a good foundation for improving the effect of track and field training. First of all, during the specific training process, teachers can strengthen the training of students' support strength in a targeted manner. This requires the full use of some relevant sports equipment to train students' single-leg support strength and single-arm support strength. Basically, each movement needs to be maintained for 30 seconds during the training process. It should be noted that during the training process, Elementary School students need to be helped to master the correct breathing method to avoid holding their breath during training. At the same time, combined with the physical tolerance of Elementary School students, the training difficulty should be increased step by step to ensure the training effect; secondly, strengthen the training of students' explosive power, which plays an important role in improving Elementary School students' reaction ability and sensitivity, and can allow Elementary School students to increase their speed in a short time. Therefore, teachers should strengthen students' explosive power training in a targeted manner according to the training plan, and use effective methods to stimulate students' limbs to respond in time; finally, carry out no-load training, and train students' limb strength through simple stretching and other projects (Yang, 2015).

Strengthen dynamic core strength training

The purpose of dynamic core strength training is to enable Elementary School students to better adapt to track and field training, thereby enabling them to fully exert their best efforts and achieve better results. During dynamic core strength training, on the one hand, teachers need to reasonably arrange and design the content and time of dynamic training. This requires teachers to combine the actual situation of Elementary School students and reasonably allocate time for movement training, free training, explosive power training, and other content to ensure that every student can actively participate in the training. At the same time, in order to avoid the dullness and tediousness of training, cross-training or adding some game-like content can be implemented, and some sports equipment can be used to increase the fun of training. On the other hand, teachers need to provide good training and guidance for Elementary School students. During the training process, teachers need to strengthen supervision and guidance of Elementary School students' training situation, provide guidance on the shortcomings of movements, and help Elementary School students get out of training misunderstandings to avoid safety problems. Only in this way can the actual effect of training be effectively improved (Kumar & Zemková, 2022).

Innovative core training process

In order to effectively improve the core strength training effect of Elementary School students, it is necessary to innovate the training process, improve the freshness of training, and thus lay a good foundation for improving the training effect. First, teachers need to constantly improve their own training methods and actively apply new training methods to improve the core strength training effect; secondly, based on students' interests, reasonably design some small games of training nature, effectively integrate training content with games, so that students can better strengthen core strength training in the game and ensure that they can achieve the core strength training goal in a funny way; finally, you can also actively carry out some competitive competitions, focusing on one of the core strength training activities, to stimulate students' competitive consciousness, create a stimulating training atmosphere for students, and then, under the influence of a good atmosphere, better promote the improvement of students' core strength.

Problems and shortcomings of core strength training in Elementary School track and field

Insufficient attention, small scale, and insufficient coverage

Currently, many schools lack a clear understanding of core strength training in elementary school track and field, with some even considering it merely an optional element of the physical education curriculum. Secondly, many schools, particularly in the field of elementary school track and field, lack specific core strength training content. Alternatively, the scale of these programs is small, limiting them to small-scale learning and failing to achieve scale advantages. Alternatively, teaching hours are too short, with only a superficial introduction to basic movements, failing to provide in-depth, systematic learning. Thirdly, the majority of learning time is spent practicing basic movements, which, while enabling students to initially achieve a similar form, lack a deep understanding and appreciation of core strength training, resulting in a similar form but not the essence (Kibele & Behm, 2009).

Teaching lacks methods, and training content is disorganized

Teaching must have formal content and be conducted diligently according to the regulations. While flexibility is permitted, it cannot be arbitrarily arranged. In actual instruction, physical education teachers often misinterpret or arbitrarily arrange the content of core strength training for athletics. While this facilitates their teaching, it leads to widely varying and disorganized understandings of core strength training among

students, even preventing the formation of an effective teaching content system. This impacts student cognition and hinders their systematic understanding and learning of core strength training.

Lack of systematic theoretical guidance and practical teaching

Core strength training for track and field is more than just a physical education component; it requires a comprehensive training methodology. However, a significant number of physical education teachers lack the expertise and methods to master core strength training, hindering the effectiveness of track and field training. Furthermore, elementary school students are relatively young, and teachers often rely on conventional strength training exercises like push-ups, sit-ups, squats, and frog jumps, which struggle to spark student interest and motivation. Consequently, a lack of systematic theoretical guidance and practical instruction makes core strength training a challenging topic for elementary school track and field training (Arazi et al., 2018).

Research subjects

This study used elementary school track and field athletes as experimental subjects to conduct a 12-week experimental study on traditional strength training and core strength training, focusing on the training effect of core strength training on developing the physical fitness of elementary school track and field athletes.

Research Methods

Documentation Method

According to the needs of this study, books and literature in related fields were obtained through channels such as Google Scholar, and China National Knowledge Infrastructure, and sorted, summarized, analyzed, and concluded to facilitate obtaining what is needed during research.

Questionnaire survey method

This questionnaire survey was conducted among 30 physical education teachers in elementary school track and field training in Anhui District, Wuhu City, with the goal of gaining a deeper understanding of the implementation and application of core strength training in elementary schools. six experts and scholars were invited to conduct a comprehensive evaluation of the questionnaire, which confirmed that the questionnaire design met the research requirements. A test-retest method was used to verify the reliability of the questionnaire. The correlation coefficient between the two

questionnaires, $R=0.876$ ($P<0.05$), was statistically significant, indicating high reliability and meeting the research requirements.

Experimental method

(1) Experimental steps.

The experimental subjects were randomly divided into two groups for 12 weeks of training, with three exercises per week and each training session lasting 30 ± 10 minutes. The performance data before and after the experiment were recorded to provide real and effective guarantees for the research on core strength training.

(2) Description of experimental training content design.

According to the training principles of elementary school track and field athletes and the laws and characteristics of physical fitness development, they should be given scientific and systematic guidance at this stage, and trained step by step, mainly emphasizing the standardization of the athletes' movements during training, and training with multiple repetitions and medium and small intensities. Since each training session of elementary school track and field athletes lasts for 90 ± 10 minutes, the training content of the two groups of athletes is the same for 60 ± 10 minutes before the training session, except for the 30 ± 10 minutes of physical fitness training. The two groups of athletes adopt different training content and methods. The control group's traditional training uses circuit training and repetition training methods, etc.

The core strength training of the experimental group used a training method that combined circuit training and interval training. The specific training content is shown in Tables 1, 2, 3, and 4 below.

Table 1

Training content of the experimental group and the control group in the first phase (weeks 1-3)

Training methods	Training content		Training volume		Interval time (min)	
	Control group	Experimental group	Control group	Experimental group	Control group	Experimental group
Control group	Push-up	Plank	15-20×3 set	15-20s×3 set	1	1
Traditional training	Sit-ups	Prone three-position	1min×3 set	15-20s×3 set	2	2

Experimental group Stabilization training in an unstable state		support one-handed evaluation				
	Supine double head raise	Prone bridge support	1min×3 set	15-20×3 set	2	2
	Subdue Jump	Side-lying shot with supported hand raised	15-20×3 set	15-20s×3 set	2	2
	Supine leg raises	Side Leg Raise	1min×3 set	15-20s×3 set	2	2

The above table compares the content, training volume, and interval time of the control group and the experimental group under different training methods. The control group used traditional training methods, and the training content included basic movements such as push-ups, sit-ups, and plank support. The training volume of each movement was 15-20 times × 3 sets or 1 minute × 3 sets, with an interval time of 1-2 minutes. The experimental group performed stability training in an unstable state, such as supine double-head raises, squat jumps, and side supports. The training volume was similar to that of the control group, but the training method was more challenging, and the interval time was slightly longer at 2 minutes. Overall, the experimental group improved core stability and athletic ability through unstable training, while the control group focused on traditional physical training.

Table 2

Training content of the experimental and control groups in the second phase (4-6 weeks)

Training methods	Training content		Training volume		Interval time (min)	
	Control group	Experimental group	Control group	Experimental group	Control group	Experimental group
Control group Traditional training	Burpees	Unilateral limb flexion and extension	20-25×3 set	15-20s×3 set	2	2
	Hopping	Single-leg, single-arm upward swing	30×3 set	15-20s×3 set	2	2

Experimental group Stabilization training in an unstable state	Supine bicycle	Supine alternating leg raises	1min×3 set	20-25×3 set	2	2
	Straight-leg sit-ups	Supine bent knee leg raises	1min×3 set	15-20s×3 set	2	2
	Supine leg raises	Straight-leg crunches	1min×3 set	20-25×3 set	2	2

This above table compares the training content, training volume and interval time of the control group and the experimental group under different training methods. The control group adopted traditional training methods, and the training content included basic movements such as push-ups and jumping. The training volume of each movement was 20-25 times $\times$ 3 groups or 30 times $\times$ 3 groups, and the interval time during training was 2 minutes. The experimental group performed stability training in an unstable state, such as supine bicycles and straight-leg sit-ups. The training volume was 1 minute $\times$ 3 groups or 20-25 times $\times$ 3 groups, and the interval time was also 2 minutes. The training of the experimental group mainly focused on enhancing core stability and motor control, while the control group focused on basic aerobic and strength training. The two groups had the same interval time, but the training content of the experimental group emphasized the instability of the movements, making the training more challenging and possibly helping to improve the body's comprehensive control ability.

Table 3

Training content of the experimental and control groups in the third phase (weeks 7-9)

Training methods	Training content		Training volume		Interval time (min)	
	Control group	Experimental group	Control group	Experimental group	Control group	Experimental group
Control group Traditional training	Push-up	Sit on a Swiss ball with one foot off the ground	15-20×3 set	15-20×3 set	2	2
	Leapfrog	Prone Swiss ball, opposite hand and foot lift	25×3 set	15-20×3 set	2	2
Experimental group	Lie on your back and	Supine Swiss Ball Forward Bend	1min×3 set	15-20×3 set	2	2

Stabilization training in an unstable state	lift your hips					
	Prone two-end rise	Supine Swiss ball	1min×3 set	15-20×3 set	2	2
	Supine leg raises	Swiss ball plank with both palms	1min×3 set	15-20×3 set	2	2

This table compares the training content, training volume, and interval time of the control group and the experimental group under different training methods. The control group performed traditional training, which included basic movements such as push-ups and jumping frogs. The training volume of each movement was 15-20 times $\times$ 3 sets or 25 times $\times$ 3 sets, with an interval of 2 minutes. The experimental group performed stability training in an unstable state, which included supine hip raises, Swiss ball forward bends, prone Swiss ball diagonal raises, etc. The training volume was 1 minute $\times$ 3 sets or 15-20 times $\times$ 3 sets, with an interval of 2 minutes. The training of the experimental group emphasized training in an unstable state, such as using Swiss balls and other unstable training equipment, to enhance core stability and body control. The interval time of the two groups was the same, but the training content of the experimental group emphasized the stability and challenge of the movements, with the goal of improving the core strength and coordination of the body.

Table 4

Training content of the experimental group and the control group in the fourth phase (10-12 weeks)

Training methods	Training content		Training volume		Interval time (min)	
	Control group	Experimental group	Control group	Experimental group	Control group	Experimental group
Control group Traditional training	Burpees	Push-ups with legs on a Swiss ball	15-20×3 set	15-20×3 set	2	2
	Prone two-end rise	One-legged Swiss ball	1min×3 set	10-15×3 set	2	2
Experimental group Stabilization training in an unstable state	Stride jump	Prone Swiss Ball Push-Up	25×3 set	10-15×3 set	2	2
	Supine leg raises	Supine Swiss ball single-leg knee	1min×3set	10-15×3 set	2	2

	bend and leg tuck					
Lie on your back and lift your hips	Supine Swiss ball with knees bent and hips raised	1min× 3set	10-15×3 set	2	2	

This table compares the training content, training volume and interval time of the control group and the experimental group under different training methods. The control group used traditional training methods, and the training content included basic movements such as push-ups and push-ups. The training volume of each movement was 15-20 times $\times$ 3 sets or 1 minute $\times$ 3 sets, with an interval of 2 minutes. The experimental group performed stability training in an unstable state, such as using a Swiss ball for push-ups, single-leg Swiss ball support, supine hip raises and other movements. The training volume was 10-15 times $\times$ 3 sets or 1 minute $\times$ 3 sets, with an interval of 2 minutes. The training focus of the experimental group was to conduct training in an unstable environment, using equipment such as Swiss balls to increase the difficulty and challenge of training in order to improve core stability and body control. Compared to the control group, the experimental group's training exercises focused more on core strength training in an unstable state, aiming to improve the athletes' balance, coordination, and stability. The intervals between the two groups were the same, but the experimental group strengthened their overall body control through unstable training.

2.2.4 Mathematical Statistics

Excel 2018 and SPSS 21.0 software were used to organize, summarize, and statistically analyze the competition data.

Analysis and Results

Questionnaire statistical results

Physical education teachers' understanding and knowledge of core strength training.

According to the practical survey, only 13% of physical education teachers are familiar with core strength training, and most physical education teachers do not know or know little about it. Only 20% of teachers believe that core strength training plays a big role. Due to the lack of understanding and familiarity of physical education teachers with core strength, this is one of the reasons why core strength training cannot be promoted and applied in Elementary School track and field training one.

It is suitable for the investigation of physical fitness evaluation indicators of Elementary School track and field athletes.

For research purposes, we collected data from 30 physical education teachers' assessments of athletes' physical fitness indicators. Based on relevant literature review and training experience, we selected the 50m run, standing long jump, 50m x 8 shuttles run, shot put, and standing with eyes closed as indicators for evaluating the physical fitness of elementary school track and field athletes. These five indicators reflect an athlete's speed, explosive power, endurance, agility, stability, and balance. By analyzing the changes in performance on these five indicators before and after the experiment, we determined the feasibility of core strength training in elementary school track and field training.

3.2 Basic information of experimental subjects

Before the experiment, the basic physical conditions of the two groups of subjects, such as age, height, and weight, were statistically analyzed, and a difference test was performed. The results showed that $P > 0.05$, as shown in Table 5, indicating that there was no significant difference in the basic physical conditions of the two groups of subjects, indicating that the two groups of subjects could be compared.

Table 5

Comparative analysis of basic information of experimental subjects

Group	gender	average age	Average height (cm)	Average weight (kg)
Control group	male	11.50 ± 0.58	158.00 ± 5.43	44.40 ± 5.59
Experimental group	male	11.30 ± 0.55	155.50 ± 5.98	45.40 ± 4.83
P-value		>0.05	>0.05	>0.05
Control group	female	11.50 ± 0.55	156.50 ± 3.29	45.00 ± 4.32
Experimental group	female	11.70 ± 0.84	159.60 ± 6.54	47.80 ± 5.50
P-value		>0.05	>0.05	>0.05

Note: $P > 0.05$ means no significant difference; $P < 0.05$ means significant difference; $P < 0.01$ means very significant difference

3.3 Test results of the subjects' physical fitness indicators before the experiment

In order to ensure the authenticity and validity of the experimental data, the five physical fitness indicators of the two groups of athletes were tested for differences before the

experiment in strict accordance with the test rules and methods, and the result was $P>0.05$. It can be seen that there is no statistically significant difference in the five physical fitness indicators, which means that the experimental data of the two groups are basically at the same level, and experimental comparative studies can be carried out.

Table 6

Statistical analysis of physical fitness indicators of the two groups of experimental subjects before the experiment

Group	gender	50m run (s)	Standing long jump (cm)	50mX8 shuttle run (s)	Forward shot put (m)	Standing tall with eyes closed(s)
Control group	male	8.24 ± 0.23	167.80 ± 5.89	99.80 ± 3.11	7.92 ± 0.99	120.40 ± 7.20
Experimental group	male	8.45 ± 0.41	169.60 ± 4.62	96.40 ± 3.91	8.12 ± 1.00	123.60 ± 5.59
P-value		>0.05	>0.05	>0.05	>0.05	>0.05
Control group	female	8.80 ± 0.39	161.00 ± 12.00	101.40 ± 6.07	7.77 ± 0.20	119.20 ± 7.85
Experimental group	female	8.85 ± 0.34	163.40 ± 6.66	101.00 ± 7.18	7.58 ± 0.47	121.00 ± 11.79
P-value		>0.05	>0.05	>0.05	>0.05	>0.05

Note: $P>0.05$ means no significant difference; $P<0.05$ means significant difference; $P<0.01$ means very significant difference

3.4 The influence of two different training modes on the changes of various physical fitness indicators

As can be seen from Table 6, after 12 weeks of the experiment, significant changes occurred in the five physical fitness indicators of the control group and the experimental group. It was found that core strength training played a key role in improving the performance of elementary school track and field athletes in 50m running, standing long jump, 50m×8 shuttle run, forward shot put, and standing with eyes closed.

Comparing the growth rates of the five physical fitness indicators before and after the experiment, the male athletes in the experimental group showed the largest improvement in their shot-put performance. Judging from the difference in data changes before and after the experiment, core strength training has enhanced the athletes' neuromuscular control ability, promoted the core muscles to conduct and integrate the power of the upper and lower limbs, and made the entire movement technique more coherent and

coordinated; secondly, the performance with the largest change was standing with eyes closed. The experimental group used Swiss ball training equipment, mainly using the Swiss ball to add more unstable exercises. More exercises in an unstable state will better improve the body's balance and control ability, thereby improving the body's coordination and stability; thirdly, after the experiment, the 50m×8 shuttle run.

The variation in performance was relatively large. The experimental group employed core strength training, which encouraged the core muscles to maintain good posture throughout the running movement, maximizing upper and lower limb force transfer and coordinated limb use, thereby improving muscle efficiency. Core strength training also had a certain effect on the athletes' 50m run performance. Core strength training improved trunk control and balance, enhanced upper and lower limb coordination, and minimized energy expenditure. Core strength training had the smallest impact on standing long jump performance. This phenomenon may be due to the training cycle being too short. Properly lengthening the training cycle, combining the two training methods, and focusing on training the deep core muscles involved in the standing long jump would achieve better results.

By analyzing, comparing, and summarizing the changes in five physical fitness indicators before and after the experiment, we determined that core strength plays a crucial role in exercise. The core muscles play a crucial role in connecting the upper and lower limbs during exercise. They form the power transmission chain between the upper and lower limbs, promoting maximum overall strength while maintaining balance, coordination, agility, and stability, thereby minimizing energy expenditure. Furthermore, the researchers found that, after implementing core strength training, athletes' motivation and interest in training increased significantly. They were able to complete various exercises in a timely and standardized manner, which also reduced the incidence of sports injuries. Therefore, Elementary-level physical education teachers must recognize the importance of core strength training, tailor it to the characteristics of students of different age groups, and truly incorporate it into elementary school physical education classes and training.

Conclusion

(1) The survey and research found that frontline physical education teachers have insufficient understanding of core strength training and little practical research, resulting in little attention to core strength training.

(2) After 12 weeks of the experiment, the five physical fitness indicators of the control group and the experimental group improved to varying degrees, indicating that

both traditional strength training and core strength training can effectively develop the physical fitness of elementary school track and field athletes.

(3) 12 weeks of core strength training had the least impact on standing long jump results. This may be because the athletes did not use their core waist muscles well and did not coordinate their whole bodies. In addition, core strength training is a long-term process and will not have a significant effect in a short period of time.

(4) After 12 weeks of training in two different modes, an independent sample t-test was conducted on the scores of the five physical fitness indicators of the experimental group and the control group. There were significant differences between the two groups. However, when comparing the two different training modes, it was found that core strength training had a more significant effect on the physical fitness of Elementary School track and field athletes.

(5) From the perspective of athletes' external training performance, the core strength training model has increased athletes' interest and initiative in training, promoted the improvement of training quality, and reduced the occurrence of sports injuries.

Recommendations

To improve the effectiveness of core strength training in primary school track and field programs, it is essential to enhance teacher training on the principles and practical application of core strength. Teachers should be provided with professional development opportunities to increase their understanding of this training method. Schools should also integrate core strength exercises into regular training routines, as they have been shown to yield more significant fitness improvements than traditional strength training. Since core strength takes time to develop, training programs should be designed with a long-term focus, setting realistic expectations for gradual progress. Additionally, athletes should be taught to improve coordination and the proper use of core muscles, particularly for events like the standing long jump. Regular assessments of training effectiveness and athlete engagement will help refine programs, ensuring sustained interest and reducing the risk of injuries.

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