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Molecular & Cellular Biomechanics 2024, 21(3), 232.
https://doi.org/10.62617/mcb232

Article

Evaluate the effect of exercise core strength training on antioxidant enzyme activity in women from a biomechanical perspective

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CITATION

Li Y, Li Y. Evaluate the effect of exercise core strength training on antioxidant enzyme activity in women from a biomechanical perspective. Molecular & Cellular Biomechanics. 2024; 21(3): 232. https://doi.org/10.62617/mcb232

ARTICLE INFO

Received: 3 July 2024
Accepted: 12 August 2024
Available online: 11 November 2024

Abstract: At present, the incidence rate of chronic diseases is increasing year by year. A variety of antioxidant enzymes in the human body, such as Superoxide Dismutase (SOD), Nitric Oxide Synthase (NOS), Glutathione Peroxidase (GSH Px), Malonic Dialdehyde (MDA) and Catalase (CAT), help to inhibit the generation of oxygen free radicals and play a certain role in preventing the occurrence of chronic diseases. The research on the activity of antioxidant enzymes and the delivery of antioxidant drugs has gradually become the focus of relevant scholars. The physical quality of women is lower than that of men, so it is of great practical significance to study the antioxidant enzyme activity of women. Therefore, this paper explores the influence of exercise core strength training on women's antioxidant enzyme activity from a biomechanical perspective and concludes that core strength training can improve female students' SOD content level by 2.58%, and can improve female students' NOS content level, GSH-Px content level, and MDA content level. Sports core strength training has a positive impact on women's antioxidant enzyme activity.

Keywords: core strength training; antioxidant enzymes; drug delivery; nitric oxide synthase; biomechanical perspective

1. Introduction

From the perspective of biomechanics, exploring the effects of exercise on human health has always been a hot topic in research. In recent years, with the in-depth development of sports science, core strength training has received widespread attention because of its unique role in improving body stability, balance, and energy output. At the same time, the activity of antioxidant enzymes is closely related to the health of the human body. They maintain the normal physiological functions of human cells through various ways such as scavenging free radicals, delaying aging, and preventing diseases. Women, especially, face special challenges in maintaining their physical health due to the particularity of their physiological structure and the psychological pressure they may bear in their social roles. Therefore, studying the influence of exercise core strength training on women's antioxidant enzyme activity will not only help us to understand the relationship between exercise and human health deeply, but also provide women with more scientific and reasonable exercise guidance. It is hoped that this research will provide new ideas and methods for the maintenance and promotion of women's health.

Antioxidant enzymes have the effect of converting peroxides formed in organisms into less toxic or harmless substances. Many scholars have studied antioxidant enzymes. Saddick Salina studied the effect of nano zinc on the activity of antioxidant enzymes in fish brains [1]. Guo studied the effects of drought stress on physiological and biochemical parameters of Lycium barbarum leaves and roots and concluded that the accumulation level of infiltration in leaves was higher than that in roots during drought, while the increase time of antioxidant enzyme activity in stressed roots was longer than that in leaves [2]. Gulati Sachin studied the impact of mobile phone signal towers on the activity of antioxidant enzymes in the human body and concluded that mobile phone signal tower hurts the activity of antioxidant enzymes in the human body through the detection of SOD [3]. Yeliz Demir believed that oxyphosphatase-1, as an important antioxidant enzyme, plays a certain role in treating atherosclerosis and many other diseases related to oxidative stress [4]. Antus Balazs believed that SOD was the main antioxidant enzyme of human lungs, and discussed the changes in SOD status in the lungs of patients with chronic obstructive pulmonary disease [5]. Ding Chenbo summarized the structure and effector function of peroxy reductase-1, its role in cancer, and the key role of reactive oxygen species in anti-cancer treatment [6]. Ighodaro O M introduced the related concepts of SOD and catalase and explored the role of SOD and CAT in the human antioxidant defense system [7]. To sum up, many scholars have devoted themselves to the research of antioxidant enzymes.

Core strength training helps the human body to improve its coordination ability and body control, maintain its upright posture, and improve its physical quality. Hsu Shih-Lin studied the effect of core strength training on core stability and experimentally proved that core strength training can enhance the core stability ability of trainees [8]. Clark Anne W studied the effects of core strength training on time spent in cross-country races and suggested that pelvic and core stability enhancement programs may help reduce time spent on off-road races [9]. Ozmen Tarik explored the effects of core exercises on the dynamic balance vertical jump height and throwing speed of handball players, and concluded through experimental research that short-term core strength training is not effective enough in improving the dynamic balance, vertical jump height, and throwing speed of young male handball players [10]. Anant S K analyzed the effects of core muscle strength exercises on fitness and body composition variables in male players in team competitions and experimentally demonstrated that an eight-week core exercise program can be very effective in delivering significant benefits for fitness level performance and body composition, as well as reducing male players' weight [11]. Rajkumar NC Jesus investigated the impact of core exercises on players' explosiveness and abdominal strength, demonstrating through stand-up long jump and sit-up test results that core exercises can play a role in increasing players' explosiveness and abdominal strength [12]. Kamatchi Murugavil analyzed the effects of core exercises on speed and upper body strength in male handball players and obtained the results by repeated measurements of reaction exhaustion analysis [13]. Although many scholars have studied core strength training, few scholars have studied the impact of core strength training on human antioxidant enzyme activity.

To study the impact of sports core strength training on women's antioxidant enzyme activity and reduce the incidence rate of chronic diseases among women, this paper puts forward some guiding strategies for sports core strength training, such as ensuring basic training, reasonably selecting training time and methods, and conducts experimental research on four antioxidant enzyme activity indicators, namely, NOS content level, GSH-Px content level, SOD content level, and MDA content level.

2. Overview of antioxidant enzymes

(1) Study on antioxidant enzymes in the human body

Antioxidant enzyme is a kind of biological catalyst that can alleviate oxidation. When peroxide is generated in the human body, the antioxidant enzyme can react in time and convert the peroxide into harmless substances through the principle of oxidation and reduction to prevent oxidation. The occurrence of human oxidation would lead to skin aging, skin lesions, chronic diseases, and other adverse consequences, and antioxidant enzymes can effectively avoid such adverse results and prevent the damage caused by oxidation to the human body [14]. Antioxidant enzymes are more active before the age of 25. During this period, the synthesis of SOD and GSH-Px is more vigorous, which plays an obvious role in controlling the generation of oxygen free radicals, ensuring the metabolic balance of the human body, and reducing the risk of chronic diseases. When the human body is over 25 years old, the activity of SOD, GSH-Px, and other antioxidant enzymes is gradually declining. SOD and GSH-Px, as the key antioxidant substances in the human body, play a huge role in enhancing human functional immunity and reducing the risk of chronic diseases. However, the growth of human age would reduce the activity of SOD and GSH-Px, thus affecting the state of human body functions.

Oxygen free radicals can affect the oxidation-reduction ability and protein synthesis ability of the human body, and reduce the immune function of the human body. With the increase of human age, due to the decline of SOD and GSH-Px activity, oxygen-free radicals can continuously damage the human body, leading to eye diseases, aging diseases, and other diseases. Given this situation, it is a good choice to increase the content of SOD, GSH-Px, and other antioxidant enzymes in the body by supplementing exogenous antioxidants [15].

(2) Classification and function of antioxidant enzymes

Antioxidant enzymes in the human body include NOS, GSH-Px, SOD, MDA, CAT, etc. NOS is widely distributed in human cells, including neuronal Nitric Oxide Synthase (nNOS), endothelial Nitric Oxide Synthase (eNOS), and inducible Nitric Oxide Synthase (iNOS). Among them, nNOS and iNOS have certain neurotoxin effects on the human body, and eNOS has certain neuroprotective effects on the human body. GSH-Px can transform toxic peroxides into non-toxic hydroxyl compounds, which can accelerate the decomposition of H_2O_2, thus inhibiting the damage of peroxides to human cell membranes. It has four main types. SOD can protect the human body from oxidation by cleaning up the superoxide anion. It has the functions of anti-aging, inhibiting tumor cells, and anti-inflammation, and is widely used in medicine, the food industry, agriculture, and other fields. SOD can be divided into copper and zinc-containing iron SOD, manganese-containing SOD enzyme, and iron-containing SOD. CAT can be extracted from chloroplasts, mitochondria in plants, and livers in animals. It can protect human cells by decomposing H_2O_2.

(3) Study on antioxidant enzymes as therapeutic drugs

Antioxidant enzymes can inhibit the tumorigenic properties of reactive oxygen species and are used as tumor prevention and anti-tumor drugs in medicine. For the delivery of antioxidant drugs, the drug itself can be modified and encapsulated, such as nanoparticles, micro nanocapsules, etc., to improve the therapeutic effect of antioxidant drugs [16]. However, the current drug delivery mode is often carried out by passive sustained release mode, and the research on active controlled release drug delivery mode is less.

3. Strategies of sports core strength training

(1) Content and method of sports core strength training

The content of sports core strength training includes two aspects. One is core stability training, and the other is core power training. The core stability training methods include static exercise, instrument exercise, vibration training, etc., as shown in **Figure 1**. Static exercise can help stabilize the muscle group of the human body and ensure the exertion of the muscle strength of the human body. It can be carried out through plate support, parallel action, back bridge, and deformation action [17,18]. The equipment exercise can exercise the muscles with large body areas. The commonly used static exercise equipment includes a balance board, wooden nail plate, iron stick insert plate, etc. As a new stability training method, vibration training can stimulate the adaptability of the human body to the external environment through the vibration of the vibration platform, to increase the stability of the human body. Vibration training can be carried out with the help of vibrators, sewing machines, and balance plates.

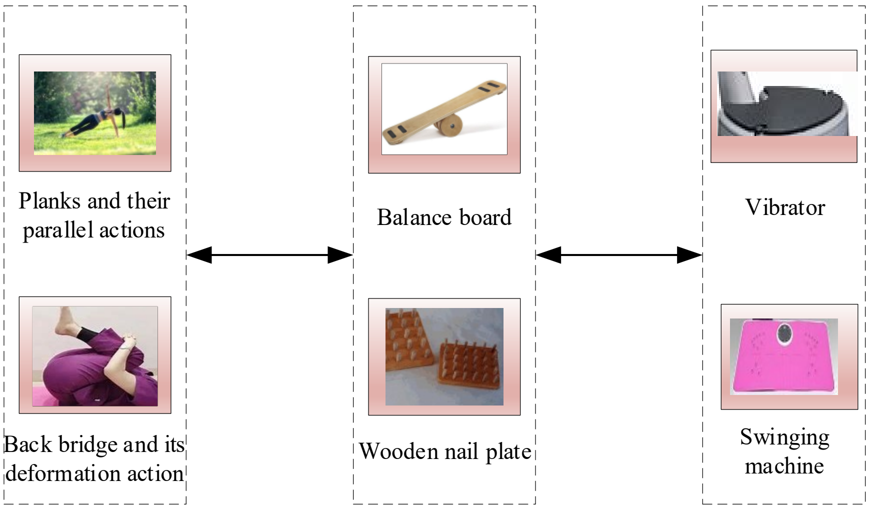

Figure 1. Methods of core stability training.

There are two forms of core dynamic training, as shown in **Figure 2**, namely bare-handed training and equipment training. The core strength training of the waist and abdomen is helpful to improve the strength of the waist and abdomen, and to prevent diseases such as lumbar disc herniation and lumbar muscle strain. In the aspect of core strength training methods in the waist and abdomen, people can use the training method of lying on the back with straight legs from both ends. Hip joint training and waist and abdomen training complement each other. Hip joint training is conducive to enhancing the anti-fatigue ability of human muscles. The methods of freehand training at the hip joint include prone hip external rotation, fire hydrant hip external rotation exercise, parallel bars supporting leg swing, etc. Equipment training based on unarmed training can increase the strength of resistance training and power-assisted training of core dynamic training, and enhance the maximum strength and explosive force of waist and abdomen muscles and hip muscles. The apparatus training methods for the waist and abdomen include weight-bearing sit-ups, weight-bearing pushups, cycling, sitting dumbbell push, apparatus belly curling, kneeling rope belly curling, elastic belt belly curling, etc. The apparatus training methods for hip joints include barbell squatting, bicycle riding, elastic belt knee walking, rubber belt resistance hip running, etc.

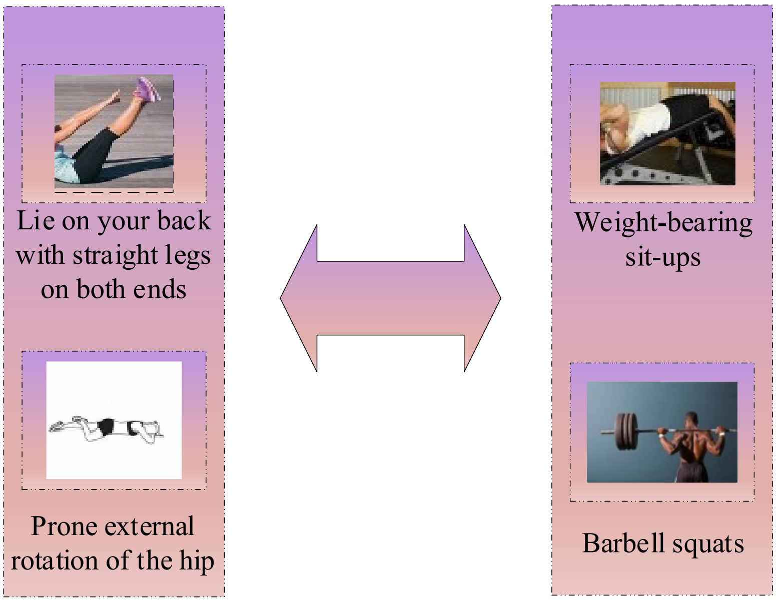

Figure 2. A form of core motivational training.

There are differences in intensity and training content between different training methods. The following is an introduction to the three training methods: 1. Balance board training: The trainer stands on the balance board with his feet shoulder-width apart, maintains the center of gravity of the body in the center of the board, fine-tunes his steps to maintain body balance, and tries to restore the initial position of the balance board. The training level is divided into beginner: maintain balance for 10 s/time, 3 groups; intermediate: maintain for 30 s/time, 5 groups; advanced: maintain for 60 s/time, 8 groups. Training progress: Beginner 3 times a week, intermediate 4 times a week, advanced 5 times a week, and gradually increase the difficulty. 2. Weighted push-ups: The body is flat and supported, with hands shoulder-width apart, and toes or knees supported. Start with a straight-arm posture and descend to the chest to touch the ground lightly or bend your elbows to 90 degrees. The training levels are divided into beginner: knee support, 10 times per group, 3 groups; intermediate: standard posture, 15 times per group, 4 groups; advanced: add extra weight, 20 times per group, 5 groups. Training progress: 3–4 times a week, gradually increase the number of times or weight, and adjust the plan every four weeks. 3. Barbell squat: Place the barbell on the trapezius muscle, hold the barbell with both hands, and the feet are shoulder-width or slightly wider. Straighten your back, look ahead, bend your knees, and squat until your thighs are parallel to or lower than the ground. The training levels are divided into beginner: empty bar, 10 times per group, 3 groups; intermediate: lightweight, 12 times per group, 4 groups; advanced: heavyweight, 15 times per group, 5 groups. Training progress: 2–3 times a week, gradually increase the weight or frequency, and adjust the plan every three months.

(2) The guiding strategy of sports core strength training

The strategy of core strength training can be analyzed from three perspectives: ensuring basic training, reasonably selecting training time and methods, and developing core strength training combined with special technical training, as shown in **Figure 3**. Basic training: when conducting core strength training, trainers should recognize the importance of core area muscles, master the skills of core strength training, regard core stability training and core dynamic training as equally important training contents, and appropriately strengthen the intensity of basic training [19,20]. Reasonable selection of training time and method: in the process of core strength training, core stability training should be the main content of the first half of the time, and the second half of the time should gradually change from core stability training to core dynamic training [21]. The training purpose should change from enhancing the stability of the trainees' muscle groups to enhancing the explosive force of the trainees' muscle groups. Therefore, the core stability training can be set in the preparation stage of training activities, and the training time can be reasonably allocated. In addition, in consideration of training difficulty, trainees should first conduct unarmed training in core strength training, and then use equipment training to increase the difficulty. Core strength training combined with special technical training is formulated: for special athletes, core strength training is conducive to improving their competition performance. Specific athletes can develop more specific training methods in combination with specific skills training when conducting core strength training.

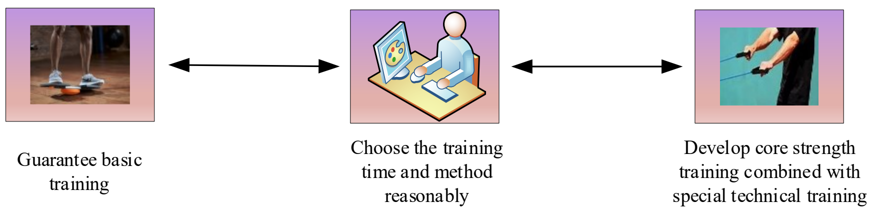

Figure 3. Sports core strength training coaching strategies.

(3) Feedback mechanism

A comprehensive physical assessment is the cornerstone of a personalized training plan. Coaches or evaluators need to conduct detailed physical assessments of participants to gain an in-depth understanding of their physical conditions and athletic abilities to ensure the safety and effectiveness of the training plan. In this process, biomechanical assessment plays a key role. It uses sensors to delve into the participants' movement patterns, posture, and movement efficiency. Through the use of advanced motion capture technology, key data such as joint angle and muscle activation of participants when performing specific movements can be accurately measured, thereby effectively identifying potential movement deviations and reducing the risk of injury. As the training progresses, the intensity will be adjusted promptly. In addition, cardiovascular function tests are equally important. This test mainly focuses on the basic conditions of cardiopulmonary function, such as the determination of maximum oxygen uptake (VO_2 max). Through the aerobic endurance test, it is possible to fully understand the aerobic ability of the participants, and then based on the test results, the aerobic part of the training can be accurately adjusted to ensure that the training is both challenging and within a safe range.

The setting of the training frequency needs to be combined with the participants' free time and recovery ability. Generally, core strength training 2 to 3 times a week is more common, but it can be adjusted according to personal circumstances. Beginners can start at a lower frequency to help the body gradually adapt to the new exercise load; while experienced trainers can increase the frequency appropriately to maintain a higher training intensity. The choice of training intensity also needs to be cautious. Beginners should start with low intensity and gradually increase to prevent overtraining. Intensity can be quantified in a variety of ways, such as using subjective force perception levels to assess training difficulty. Those with a training foundation can choose higher intensity, but sufficient recovery time should be ensured to reduce the risk of overtraining. The types of training should be diversified to comprehensively exercise different core muscle groups. As the training progresses, the training plan should be gradually adjusted. An effective strategy is to gradually increase the complexity or intensity of training. In the early stage, you can focus on the learning of correct movements, and then gradually introduce more complex movement combinations or increase the weight to increase the difficulty of training. Such an arrangement helps to continuously challenge participants and promote adaptive changes in the body, to achieve long-term progress and development.

Regular monitoring and evaluation are an indispensable part of the training plan. It is usually recommended to conduct a comprehensive re-evaluation every 4–6 weeks to ensure the effectiveness and adaptability of the training. By re-measuring the biomechanical parameters, the coach can observe the improvement of the participants in specific movements, such as whether the stability of squats or push-ups is enhanced, to determine whether the core strength and movement efficiency have improved. In addition, monitoring antioxidant enzyme activity is also an advanced means to track its changes through blood tests to assess the body's adaptability to training stimuli and its ability to resist oxidative stress, which is particularly important for high-intensity trainers. According to the monitoring and evaluation results, the training plan needs to be adjusted accordingly. If you make significant progress, you can increase the complexity or intensity of training, such as increasing weight or trying more challenging movements, to continue to promote progress and avoid stagnation. If progress is slow, you need to consider adjusting the training frequency, reducing the intensity, or changing the training type. In the event of discomfort or injury, the training load should be reduced immediately and medical advice should be sought in time to ensure that the health and safety of participants always come first. Proper rest is as important as rehabilitation measures to avoid further injury.

(4) Serum antioxidant enzyme activity index test

First, the subject's serum was collected through the following process: 45mL of elbow vein blood was taken from the subject on an empty stomach in the early morning, and it was centrifuged at a speed of 2500 r/min for a total of 10 min. The supernatant was moved to a plastic tube and stored at −70℃. Set aside. Serum antioxidant enzyme activity indicators: nitric oxide synthase, glutamate glycoprotein peroxidase, superoxide dismutase, and malonic acid were tested by enzyme-free method. The kit was provided by the Nanjing Jiancheng Institute of Biological Engineering. The test instrument uses the DGSO33A enzyme marker produced by East China Electronics Company.

4. Evaluation of the effect of core strength training on the activity of antioxidant enzymes

In this paper, the Perceived Stress Scale (PSS) is used to assess the stress level of subjects. The scale is widely used in the fields of psychology, health sciences, and social sciences. PSS can not only help us better understand the psychological state of subjects under specific environments or experimental conditions, but also provide researchers with valuable data resources to better control the potential interfering factor of stress in subsequent data analysis. As an effective tool, PSS is widely used to measure an individual's perception of life stress in the past month. Through a series of well-designed questions, the scale can accurately assess the subject's stress feelings. In the course of experimental research, it is essential to regularly use PSS to assess the stress of subjects. This approach helps to capture dynamic fluctuations in stress levels, thereby more accurately reflecting the subjects' psychological conditions at different points in time. In addition, regular assessments can also reveal the impact of experimental conditions or interventions on subjects' stress levels, providing researchers with key clues about the effect of the experiment. Through continuous stress monitoring, researchers can detect and respond to abnormal stress reactions that may affect the results of the study promptly, thereby ensuring the accuracy and reliability of the data. The inclusion of stress levels in the analysis model helps researchers to more accurately evaluate the actual impact of experimental conditions or interventions on the main research variables, reduce potential deviations and confusion, and improve the robustness and credibility of research conclusions.

Vicon infrared optical motion capture technology is used to collect kinematics data. The system configuration includes 8 capture lenses evenly distributed in the capture area, as well as 9 network cables connecting the host and each camera and other key equipment. To operate this system effectively, it needs to be used with Vicon Nexus2. 9. 1 software. In the data collection link, the subject is required to be in the motion capture area and complete the corresponding actions as required. Subsequently, the computer software will post-process the collected raw data, including continuous point operation, data integration, and subsequent in-depth analysis of the APP.

100 women will be randomly divided into two groups of 50 each, who were aged between 16 and 50 years. One group of female students had a four-week core

strength training, which was called Group C; the other group of female students did not carry out core strength training and maintained the same conditions as Group C female students in terms of diet, work, and rest. This group was called Group T. The core strength training methods adopted by female students in Group C were balance board, weight-bearing push-ups, and barbell squats. They were trained five days a week, but not on Saturdays and weekends. The daily training time is 150 min, including 75 min in the morning and 75 min in the afternoon. The contents of NOS, GSH-Px, SOD, and MDA in female students of the two groups were taken as the test indicators of antioxidant enzyme activity.

Before the start of the experiment, saliva or blood samples of participants were collected for subsequent genetic analysis. Use standardized collection tools and protocols to ensure the quality and consistency of samples. Conduct genotyping analysis, focusing on gene variants related to antioxidant enzyme activity. Analyze the relationship between these gene variants and changes in antioxidant enzyme activity before and after training. The two groups of Group C and Group N matched in terms of age, weight, height, and basic physical fitness. Collect saliva samples: use a commercial DNA collection kit. Collection of blood samples: Venous blood samples are collected by professional medical staff in hospitals or clinics. Use statistical software for data analysis. The basic information of female students in Group C and Group T is shown in **Table 1**.

Table 1. Basic information of female students in Group C and female students in Group T.

	Group C	Group T
Number of people/person	50	50
Age/year	31. 35	31. 93
Weight/kg	84. 41	83. 37

As shown in **Table 1**, the average age of female students in Group C is 17.35 years old, and the average weight is 84.41kg. The average age of female students in Group T is 17.93 years old, and the average weight is 83.37kg.

(1) SOD content level

After 30 min of core strength training every week for female students in Group C, the blood samples of female students in Group C and Group T were collected, and the SOD content level in the bodies of the two groups of female students was tested with xanthine. The unit of the SOD content level was $U \bullet mL^{-1}$, and the results of the SOD content level were shown in **Figure 4**.

As shown in **Figure 4**, the SOD content level of female students in Group C in the first week was 81.02, and that of female students in Group T was 79.25. The SOD content level of female students in Group C in the first week was 1.77 higher than that of female students in Group T, indicating that core strength training played a certain role in improving the SOD content level of female students, which was reflected in the first week. The SOD content of female students in Group C in the fourth week was 82.06, and that of female students in Group T was 79.46. The SOD content of female students in Group C in the fourth week was 2. 6 higher than that of female students in Group T. The average SOD content for the four weeks of female students in Group C was 81.45, and the average SOD content around the four weeks of female students in Group T was 79.4. The average SOD content around the four weeks of female students in Group C was 2.05 higher than the average SOD content around the four weeks of female students in Group T, with a proportion of 2.58% higher, indicating that core strength training can improve the SOD content level of female students and the antioxidant enzyme activity in female students.

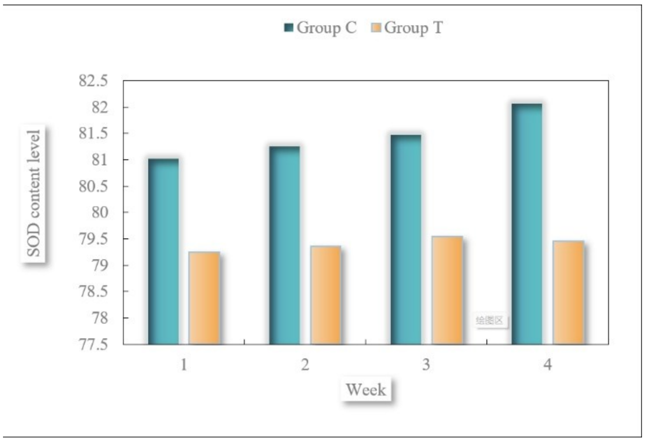

Figure 4. SOD content levels of female students in Group C and female students in Group T.

(2) NOS content level

This paper records and collates the level of NOS content in female students of Group C and Group T, and the unit of which is $U \bullet mL^{-1}$. The specific results are shown in **Figure 5**.

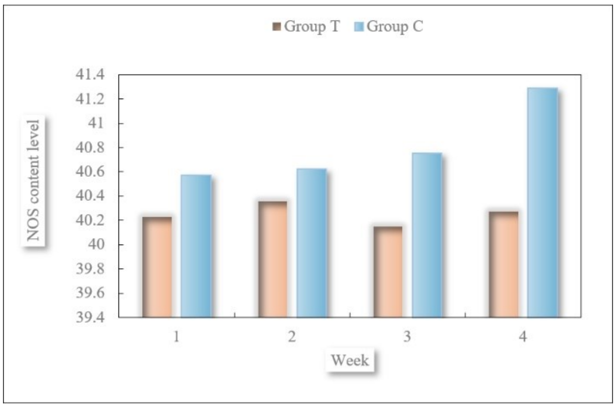

Figure 5. NOS content levels of female students in Group C and female students in Group T.

As shown in **Figure 5**, in the first week, the level of NOS in female students in Group C was 40.57, and that of female students in Group T was 40.23. The level of NOS in female students in Group C was 0.34 higher than that in female students in Group T. In the second week, the level of NOS in female students of Group C was 40.62, and that in female students of Group T was 40.36. The level of NOS in female students of Group C was 0.26 higher than that in female students of Group T. In the third week, the level of NOS in female students of Group C was 40.75, and that in female students of Group T was 40.15. The level of NOS in female students of Group C was 0.6 higher than that in female students of Group T. In the fourth week, the level of NOS in female students of Group C was 41.29, and that in female students of Group T was 40.27. The level of NOS in female students of Group C was 1.02 higher than that in female students of Group T. From the average level of NOS content of the two groups of female students, the average level of NOS content of female students in Group C was 40.81, and the average level of NOS content of female students in Group T was 40.25. The average level of NOS content of female students in Group C was 0.56 higher than that of female students in Group T, indicating that core strength training has a certain role in improving the level of NOS content of female students.

(3) MDA content level

Thiobarbital acid was used to test the MDA content level of the two groups of female students. The unit of the MDA content level is $nmol \bullet mL^{-1}$, and the specific results are shown in **Figure 6**.

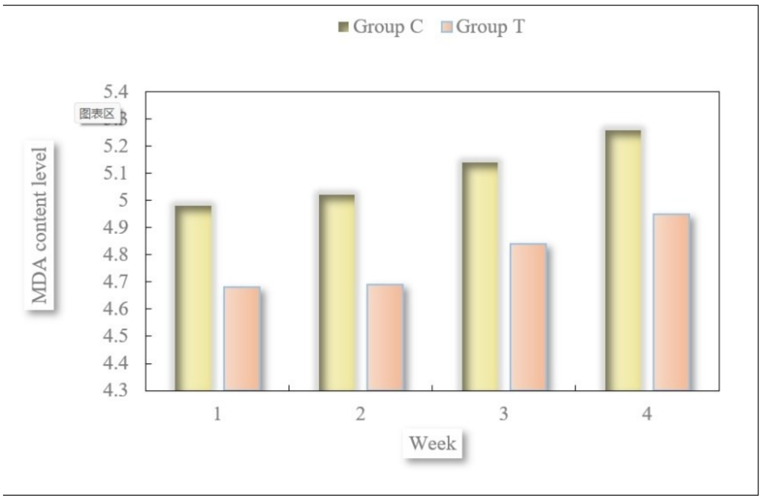

Figure 6. MDA content levels of female students in Group C and female students in Group T.

As shown in **Figure 6**, the MDA content level of female students in Group C in the first week was 4.98, and that of female students in Group T in the first week was 4.68. The MDA content level of female students in Group C in the first week was 0.3 higher than that of female students in Group T. The MDA content level of female students in Group C in the second week was 5.02, and that of female students in Group T was 4.69. The MDA content level of female students in Group C in the second week was 0.33 higher than that of female students in Group T. The MDA content level of female students in Group C in the third week was 5.14, and that of female students in Group T in the third week was 4.84. The difference between the two groups was 0.3. The MDA content level of Group C female students in the fourth week was 5.26, and that of Group T female students in the fourth week was 4.95. The difference between the two groups was 0.31. The average MDA content of female students in Group C was 5.1, and that of female students in Group T was 4.79.

The average MDA content of female students in Group C was 0.31 higher than that of female students in Group T.

(4) GSH-Px content level

This paper records and collates the GSH-Px content level of female students in Group C and Group T, and the unit of GSH-Px content level $U \bullet mL^{-1}$, and the specific results are shown in **Figure 7**.

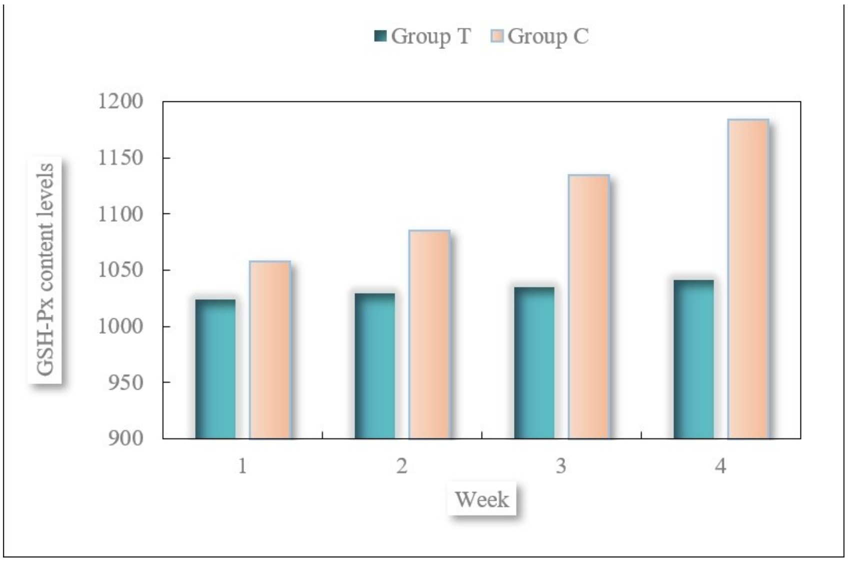

Figure 7. GSH-Px levels of female students in Group C and female students in Group T.

As shown in **Figure 7**, on the whole, the GSH-Px content of female students in Group C is higher than that of female students in Group T. According to the specific data, in the first week, the GSH-Px content level of female students in Group C was 1057.67, and that of female students in Group T was 1024.23. The GSH-Px content level of female students in Group C was 33.44 higher than that of female students in Group T. In the second week, the GSH-Px content of female students in Group C was 1085.36, and that of female students in Group T was 1029.54. The GSH-Px content of female students in Group C was 55.82 higher than that of female students in Group T. In the third week, the GSH-Px content of female students in Group C was 1134.59, and that of female students in Group T was 1035.28. The GSH-Px content of female students in Group C was 99.31 higher than that of female students in Group T. At the fourth week, the GSH-Px content of female students in Group C was 1184.26, and that of female students in Group T was 1041.26. From the average GSH-Px content level of the two groups of female students around the week, the average GSH-Px content level of female students in Group C is 1115. 47, and the average GSH-Px content level of female students in Group T is 1032.58. The average GSH-Px content level of female students in Group C is 82.89 higher than the average GSH-Px content level of female students in Group T. The above data shows that core strength training can significantly improve the GSH-Px content level of female students, and can enhance the antioxidant enzyme activity of female students.

To ensure that the training plan is both challenging and in line with personal physical fitness, this study will observe changes in antioxidant enzyme activity over four weeks. This involves determining the intensity, frequency, duration, and specific core training actions of training. The training intensity is selected by the maximum number of repetitions method. Beginners can start with a maximum number of repetitions of 60%–70%, while experienced trainers can try a higher intensity of 80%–90%. Core strength training 2–3 times a week is a common frequency. Low-frequency training for beginners helps the body adapt, while experienced people may need higher frequencies. Each core strength training is recommended to last for 30–60 min to avoid excessive fatigue or insufficient stimulation. Training should include different types of exercises, such as stability ball and suspension training. To track long-term changes, multiple time points need to be set to detect antioxidant enzyme activity, such as weekly, biweekly, or monthly, depending on the accuracy and feasibility of the study. The use of advanced testing technologies is essential for accurate measurement, such as modern biochemical experimental technologies, which are usually carried out in professional laboratories and operated by professionals. Among them, enzyme-linked immunosorbent assays are widely used because they can detect specific protein concentrations.

5. Conclusions

This paper briefly describes the classification and function of antioxidant enzymes, puts forward some methods and guidance strategies for sports core strength training from the perspective of biomechanics, conducts experimental research on the impact of core strength training on antioxidant enzyme activity, and draws the following conclusions: sports core strength training can improve the level of SOD content of female students, and can improve the level of NOS content of female students. Sports core strength training can play an important role in improving the level of MDA content and GSH-Px content of female students. Sports core strength training can also improve the antioxidant enzyme activity of female students.

Author contributions: Conceptualization, YL (Yingshun Li); methodology, YL (Yingxue Li); software, YL (Yingshun Li); validation, YL (Yingshun Li) and YL (Yingxue Li); formal analysis, YL (Yingshun Li) and YL (Yingxue Li); investigation, YL (Yingshun Li); data curation, YL (Yingxue Li); writing—original draft preparation, YL (Yingshun Li) and YL (Yingxue Li); writing—review and editing, YL (Yingshun Li) and YL (Yingxue Li). All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the Education Reform Project of the Education Department of Guangdong Province in 2021: Construction of PE teaching quality evaluation index System in a private university under the background of ideological and political Curriculum—Taking Pearl River College of South Agricultural University as an example.

Ethical approval: Not applicable.

Conflict of interest: The authors declare no conflict of interest.

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