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The Influence of Improving Core Strength on Sports Performance in Gymnastics Training

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Abstract: The purpose of this study is to explore the effect of core strength training on aerobics athletes. Through literature analysis, expert interviews, logical analysis, and experimental methods, the effects of specialized core strength training and traditional core strength training are compared. Taking 40 female students from a university's aerobics class as an example, they were randomly divided into experimental group A (n=20) and control group B (n=20) for a nine week training period. The experimental group received specialized core strength training, while the control group received traditional core strength training three times a week for 30 minutes each time. The results showed that after nine weeks of training, both training methods significantly improved the core strength of female aerobics athletes in universities. However, there were significant differences ($P<0.01$) in the core strength test results between the experimental group and the control group, except for the prone back muscle at both ends ($P>0.05$). The conclusion indicates that the enhancement of core strength has an important promoting effect on the specialized performance of aerobics athletes, which helps to improve their sports skills and competitive level.

1. Introduction

In the field of sports, especially gymnastics, which combines art and strength, competition has become increasingly fierce with the development of the times and technological innovation. For the women's gymnastics team, relying solely on traditional methods is far from enough to stand out on the international stage. These methods often overlook the comprehensive needs of modern athletes for skills, strength, and physical abilities. Therefore, in order to adapt to this change, female gymnastics coaches have begun to seek more efficient training modes. In contrast, core strength training is particularly important [1]. This type of training not only focuses on the external performance of the body, but also emphasizes the coordinated operation of internal muscle groups and the improvement of overall function. Through scientific and systematic core muscle training, female athletes can significantly improve their specialized skills within a limited time, while also being able to more accurately grasp the key points of each movement. This training method not only helps athletes establish a strong and stable torso, but also enhances their stability when completing difficult techniques, making their movements appear smoother and more natural, thus winning the favor of referees and applause from the audience on the field [2-3].

Over time, core strength training has gradually become recognized as an effective means in the

gymnastics industry. It promotes the balanced development of overall strength by exercising the core muscle groups of athletes' abdomen, back, buttocks, and legs, providing a solid foundation for achieving higher difficulty gymnastics movements. In this process, every female gymnast can feel their progress and achieve transcendence through continuous self challenge. The role of core strength training is mainly manifested in four aspects: 1) Controlling the stable state of core muscles, which is conducive to mastering advanced technical movements and sports tactics; 2) Developing good physical abilities; 3) Prevent injuries and prolong exercise life; 4) Beneficial for athletes to maintain a stable and good psychological state during training and competition. Through years of in-depth and comprehensive research, they have organically combined the theoretical mechanisms of core strength training with practical applications, proving through practice that core strength training can improve athletes' competitive performance. Therefore, the author aims to analyze the specific impact of systematic core strength training on the improvement of core strength and athletic performance of gymnasts, in order to provide more scientific guidance for gymnastics training [4].

2. Research Methods

2.1 Research Object and Method

2.1.1 Research Object

The author takes the specialized core strength training method for female aerobics athletes in universities as the research object, and female students in the general major of an aerobics class in a certain university as the experimental object.

2.2 Methods

2.2.1 Literature review method

By searching for keywords such as "aerobics", "core strength training", and "female aerobics athletes" on academic websites such as China National Knowledge Infrastructure, Wanfang, VIP, and Nanjing University of Science and Technology Library, the collected and queried literature and book materials were sorted and screened, and the relevant materials were integrated to provide the author with a certain theoretical basis for research. By searching databases, as of 2024, there are 234 literature related to core strength training methods. By combining and organizing with knowledge of training, reliable theoretical guidance can be provided for the author [5].

2.2.2 Expert Interview Method

In order to conduct in-depth exploration and research on the training methods, testing indicators, and other related issues of core strength in aerobics, and to obtain valuable information to assist me in completing this research. The author conducted expert interviews with eight influential experts, coaches, and athletes in the field of competitive aerobics and sports training, including Nanjing University of Science and Technology and Nanjing Sport University, on the training methods and indicators of core strength in aerobics. Among them, there are 2 professional coaches, 2 professors, 2 national level referees, and 2 high-level athletes. The main purpose is to extensively collect the content and methods of core strength training for female aerobics athletes in universities, the experimental design of the paper, and the evaluation indicators of core strength testing, in order to provide constructive suggestions for the author's research [6].

2.2.3 Experimental Method

The experiment will be conducted from October 2023 to December 2023, with a duration of 2 months. The experimental subjects were 40 undergraduate female students from the gymnastics specialized class at Nanjing University of Science and Technology. The 40 female students were divided into two groups for the experiment, namely experimental group A (n=20) and control group B (n=20). In order to ensure the effectiveness of the experiment, professional instructors and coaches conducted aerobics related tests and teaching for the experimental aerobics athletes before and after the experiment. After the specialized course training in experimental group A, a half-hour specialized core strength training intervention was conducted, and in control group B, a 30 minute traditional core strength training was also conducted after the specialized course training. The core strength training time for the experimental and control groups is half an hour after each class, with three training sessions per week. A total of 9 weeks of training were conducted, while data recording and collection were carried out to obtain experimental results.

2.2.4 Mathematical and Statistical Methods

Firstly, the relevant test data obtained before and after the experiment will be recorded and saved. The collected data will be input into an Excel sheet for statistical evaluation, and specialized software will be employed to perform comparative analysis. Through this process, differences between the experimental and control groups will be identified. A paired sample t-test will be applied to assess changes within each group before and after the experiment, while an independent sample t-test will be utilized to compare results between the two groups. Finally, the improvement, impact, and inter group comparison of the two training forms of aerobics specific core strength training method and traditional core training method on the test indicators will be obtained, from which conclusions can be drawn [7].

2.3 Experimental and testing indicators

2.3.1 Experimental Time

A 9-week training program. Train three times a week on Mondays, Wednesdays, and Fridays, with each core strength training session lasting half an hour.

2.3.2 Experimental subjects

Table 1: Comparative analysis of basic information between experimental group and control group

Basic information	experimental group(n=20)	control group(n=20)	P value
Age (years)	20.14±0.67	20.04±0.37	0.622
Height (cm)	164.30±2.40	13.10±2.70	0.152
Weight (kg)	47.70±2.35	47.64±1.63	0.932

The experimental subjects were selected from female students in a specialized aerobics class at a certain university to ensure consistency in the teaching environment. Divide 40 female students in the same class into an experimental group (20 students) and a control group (20 students). Based on the preliminary investigation of basic demographic data prior to the experiment, the ages of participants in both the experimental and control groups ranged from 19 to 23 years, with an average height of 164.4 cm and an average weight of approximately 47.8 kg. Analysis using an independent sample t-test showed that the P value was greater than 0.05, indicating no significant

differences in height, age, or weight between the two groups. This confirms that the groups are comparable and suitable for further experimentation, as detailed in Table 1.

3. Results Analysis

3.1 Comparative analysis of core strengths before and after the experiment

(1) The core strength test indicators of the experimental group before the experiment are shown in Table 2:

Table 2: Core Strength Test Index Data of Experimental Group before Experiment

Serial Number	Lying on both sides for 60 seconds per time	Prone position with back muscles at both ends for 60 seconds per session	Fifth level side bridge left (divided)	Fifth level side bridge right (divided)	Six level overhead bridge (divided)	Eighth level abdominal bridge (score)
A1	25	32	3	3	1	3
A2	22	39	1	1	3	8
A3	32	34	1	3	3	2
A4	15	35	3	2	3	1
A5	22	37	3	3	3	3
A6	15	36	1	1	8	3
A7	15	41	1	3	3	8
A8	15	24	3	2	2	3
A9	21	35	1	8	8	8
A10	22	26	3	1	3	14
A11	14	32	1	8	2	2
A12	24	24	3	1	3	3
A13	25	37	1	3	8	8
A14	18	56	8	8	1	14
A15	26	21	8	1	3	3
A16	25	34	8	3	1	1
A17	24	31	1	1	3	3
A18	24	21	8	3	3	1
A19	32	32	1	3	3	1
A20	25	33	3	1	3	1

(2) The core strength test indicators of the control group before the experiment are shown in Table 3:

According to Tables 2 and 3, it can be seen that there were issues with non compliant movements in the supine position, prone position, and triple bridge test, resulting in lower test scores. When conducting a Level 5 side bridge test, athletes may experience issues such as supporting elbows at right angles, bending of the back of the body, inability to extend legs straight, bent knees, and insufficient opening angles. During the Level 6 overhead bridge test, athletes experienced body

shaking, hip rest, knee bending, and other non-standard movements. During the eighth level abdominal bridge test, non-standard movements such as not being able to straighten the head, collapsing the waist, raising the hips too high, and shaking the body are particularly common. In summary, these non-standard movements indicate that athletes' core muscle strength is generally weak, and there is an urgent need to strengthen core strength training [8].

Table 3: Core Strength Test Index Data of the Control Group before the Experiment

Serial Number	Lying on both sides for 60 seconds per time	Prone position with back muscles at both ends for 60 seconds per session	Fifth level side bridge left (divided)	Fifth level side bridge right (divided)	Six level overhead bridge (divided)	Eighth level abdominal bridge (score)
B1	22	35	1	3	1	3
B2	21	31	8	1	3	3
B3	18	35	3	3	3	1
B4	16	34	3	1	3	3
B5	20	31	1	3	3	1
B6	22	23	8	1	3	3
B7	24	5	1	1	3	8
B8	16	24	8	1	1	2
B9	17	35	1	3	1	3
B10	21	40	1	1	1	8
B11	17	44	3	3	4	14
B12	25	32	3	1	1	1
B13	22	24	8	8	8	3
B14	18	20	3	1	14	2
B15	24	22	1	1	1	3
B16	23	34	8	1	3	1
B17	25	23	3	8	3	8
B18	21	32	8	1	3	3
B19	20	31	8	1	3	3
B20	15	21	1	1	8	1

The comparative analysis of core strength test indicators between the experimental group and the control group before the experiment is shown in Table 4:

The author randomly divided 40 female students in the specialized gymnastics class of ordinary universities into an experimental group and a control group, and conducted pre experiment core strength training index tests. Then, the pre experiment test index data of the two groups were compared and analyzed. The analysis results from Table 4 showed that there were some slight differences in the analysis of inter group comparison through independent sample t-test before the experiment, but the differences were not significant. The t-values for the five-level side bridge (left), five-level side bridge (right), six-level back bridge, and eight-level abdominal bridge were 1.324, 1.310, -0.624, 1.001, 0.000, and 0.7615, respectively. With a confidence interval of 94%, the corresponding P-values were 0.180, 0.202, 0.420, 0.2615, 1.000, and 0.361, all of which are much greater than 0.05. These results indicate that there were no significant differences in core strength test metrics between the experimental and control groups prior to the experiment, and the test

indicators all exhibit a normal distribution. When comparing the significance of the test indicators before the experiment, it meets the T-test standard. This indicates that subsequent experiments can be conducted [9-10].

Table 4: Comparative analysis of core strength test indicators between experimental group and control group before the experiment

Test indicators	group	mean value (X±S)	T value	P value
Lie on your back with both ends up	experimental group	22.04±1.182	1.324	0.180
	control group	20.10±0.605		
Prone position with back muscles rising from both ends	experimental group	32.70±1.643	1.310	0.202
	control group	30.70±1.387		
Fifth level side bridge (left)	experimental group	3.54±0.574	-0.624	0.420
	control group	4.20±0.620		
Fifth level side bridge (right)	experimental group	3.30±0.515	1.001	0.212
	control group	2.44±0.462		
Six level overhead bridge	experimental group	4.01±0.451	0.000	1.000
	control group	4.01±0.674		
Eighth level abdominal bridge	experimental group	5.04±1.003	0.615	0.361
	control group	4.20±0.728		

In summary, through statistical comparison and analysis of data from the experimental group and the control group, the author believes that the reason why the specialized core training method has improved the test indicators is as follows: At the beginning, the training method designed by the author was to transition from manual static exercises to dynamic exercises, following the principle of gradual progress and increasing difficulty, so that athletes who have never been exposed to systematic training can gradually adapt to the intensity and load of sports training and overcome fear of difficulty. Then, combined with equipment exercises, athletes can exercise their deep core muscle groups to improve core stability and enhance the quality of their movements. Finally, with the help of equipment during training, the difficulty of training was increased, and the non stability training and resistance training in sports training were strengthened, allowing athletes to receive greater degree and greater load training, thereby improving their core strength.

4. Conclusion

The research results indicate that through nine weeks of training, both traditional core strength training and specialized core strength training can significantly improve the core abilities of female university aerobics athletes. However, through comparative analysis, there was a significant difference ($P<0.01$) in the core strength test indicators between the experimental group and the control group after the experiment, except for the prone back muscle at both ends ($P>0.05$). Therefore, specialized core strength training in aerobics is superior to traditional core strength training in improving the core strength of female aerobics athletes in universities.

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