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The Influence of Core Strength Training on the Physical Quality of Students with Disabilities

Mei Zhang
College of the Special Education
Leshan Normal University
Leshan, China 614000

***Abstract*—This study selected 25 students from the Society-adaption Department of Leshan Special Education School as the research object, and used the core strength training program to train different projects for 15 weeks, 3 times a week, 45 minutes per exercise, and rest in weekend. The physical response of the students was observed as an exercise intensity monitoring measure during the experiment. The experimental results show that the excellent proportion of 30s 30 times of squat data increases, the speed of 4s running (m) increases, the distance of stomach back stretch (cm) increases, the speed of 50 meters run increases, and the distance of standing long jump increases. This research shows that core strength training has a significant impact on the physical fitness of students with disabilities (society-adaptation students), which can improve the performance of related projects, indicating that core strength training methods can be applied in special sports training/teaching.**

Keywords—core strength; society-adaptation students; physical fitness

I. INTRODUCTION

The core strength has become a new term for physical exercise. The core strength exists in all sports. All sports movements are the movement chain with the central myocardial group as the core, and the strong core muscles play a stable and supporting role in the body posture, motor skills and special technical movements in the movement. Core strength training is the training of the strength, stability, balance and other abilities of the core muscles and their deep muscles. Stability is the main purpose of the core pre-training. Core strength training is the basis for other sports abilities, such as speed, agility, coordination and other quality training. After studying by different scholars, the core muscles' range is believed as from the middle of the chest to the middle of the thigh, including the front, the sides and the back which can regulate the body weight of the muscles to maintain the balance of the trunk. It mainly includes a variety of muscles on the chest, back, abdomen, waist and hips that can maintain body posture, regulate the body's weight and maintain the balance of the trunk.

Chen Tiancong selected 50 children with cerebral palsy and randomly divided into control group and experimental group. The control group received routine rehabilitation therapy. The experimental group added core stability training based on conventional rehabilitation therapy. The Biodex Balance System (BBS) was used to evaluate the balance function before and after treatment. After 12 weeks of treatment, the balance function of the experimental group was significantly better than that of the control group ($P<0.05$). Studies have shown that on the basis of conventional rehabilitation therapy, the use of core stability training can significantly improve the balance function of children with cerebral palsy, and is an effective method and means for rehabilitation of children with cerebral palsy. Many coaches used core strength training in track and field, basketball, gymnastics, martial arts, tennis, windsurfing, synchronized swimming, walking, archery, trampoline, fencing and other special training, which achieved good results. The strength of the core strength and the ability of the muscles to coordinate work have an influence on the control of the body's center of gravity, the change of posture, the transmission of force between the limbs, the speed of body movement, and the direction of movement. This is also the reason why more and more people engaged in sports training attach importance to core strength training.

The core strength is very important in people's daily life and work, but it has not been widely valued in special sports in special schools. Most of the research on core strength training is aimed at professional athletes in competitive sports and research on the general population, but little research has been done on special groups (especially students with disabilities). How to apply core strength training to the rehabilitation of special school sports and disabled students is a problem that many sports workers should actively think about and solve.

In this study, 25 disabled students from the Department of Society-adaption were selected as the research object, and the methods of core strength training in domestic and overseas were arranged. A set of corresponding training programs was set up for the physical and mental characteristics of the students of the special school. Through the experiment, the impact of core strength training on the physical fitness of disabled students is studied from the perspective of physical health, in order to understand how the core strength training affects the physical health of special groups. If core strength training has a positive impact on the physical fitness of students with disabilities, then core strength training can be introduced in the physical education

classes of special education schools, which can not only improve the physical fitness of students with disabilities, but also enrich the content of special physical education classes. At the same time, it can also provide experimental and theoretical basis for the core strength training of special people.

II. Research Objects and Methods

A. Research Objects

There are 14 students with disabilities in a special school in Leshan, and the following relevant test indicators were tested before and after core strength training. (See "Table I")

TABLE I. List of Basic Information of Research Subjects

Name	Gender	Age	Type of obstacle entry item
Zhang**	male	18	mental retardation roller skating
Ma**	male	19	mental retardation football
Liu*	male	19	mental retardation football
Xie **	female	17	mental retardation
Zhao **	male	17	mental retardation football
Ren*	female	17	mental retardation weightlifting
Shuai**	male	17	mental retardation badminton
Xu**	male	17	mental retardation football
Wang**	female	17	mental retardation skating
Zhang*	female	18	intellectual disorder athletics
Chen*	male	19	mental retardation
Zhang*	male	19	mental retardation
Zhang**	male	18	mental retardation weightlifting
Lei **	female	17	mental retardation

B. Research Methods

1) Main test equipment: Stopwatch, measuring tape, solid ball, hair whistle, marker, and soft cushion.

2) Test indicators and methods: Taking the sensitivity of the indicators into account, and synthesizing "Physical Activity Testing and Assessment" and "Sports Measurement and Evaluation" and other related physical testing indicators books, the following test indicators were selected.

Body shape: height (cm), weight (kg)

Physical function: quiet heart rate (b/min), 30s 30 times squat

Physical fitness: 4s fast running (m), standing long jump (m), trunk extension test (cm), 1 minute sit-up (time / min), 50-meter sprint (s).

The test process is carried out in strict accordance with the test methods, test procedures, test requirements, and test precautions of the "Sports Measurement and Evaluation", "Human Exercise Ability Test and Evaluation", and "The Latest National Fitness Test Work Manual", etc.

3) Exercise plan: The core strength training group (experimental group) performs 3 times of sports training per week. The content of the exercise training is the core strength exercises: the exercise intensity is reflected by the heart rate, and is controlled between 125-140 times/min. Each exercise time reaches 55-60 minutes. Among them, there must be 5-8 minutes of preparation activities, 45-60 minutes of core strength training, and 10-12 minutes of relaxation exercises. The time is scheduled for Monday, Wednesday and Friday from 16:00 to 17:30. Core strength training lasts for one semester, with three weeks before the formal experiment to adapt to the training content, and the fourth week officially stepping into the experimental phase. Core strength training content:

Form 1: Free core strength training content, single-person practice without any equipment. This type of exercise is suitable for the initial stage of core strength exercises. It is generally required to train 3-4 groups each time, and each group lasts for 15-20s.

a) Demi-Pli: Action essentials: With both hands on the hips, the two feet are separated, then they do Demi-Pli with their knees half-squatted, and their backs straight.

The purpose of this action training is to exercise gluteus maximus, rectus femoris, rectus abdominis, and tensor fascia latae.

b) Kneeling straight back support: Action essentials: The two feet are close together, the two hands support the ground, the back is straight, and the legs are bent as 90 degrees.

The purpose of this action training is to exercise latissimus dorsi, gluteus maximus, erector spinae, and biceps femoris.

c) Side-bending with legs apart: Action essentials: With both hands on the hips, the body is attached to the lower left, and the body leans down to the right.

The purpose of this action training is to exercise the external oblique muscle, intra-abdominal oblique muscle, and lumbar muscle.

d) Lying leg raises: Action essentials: the body is lying flat; hands open the rain-proof ground; the lower abdomen exerts force; the knees are stretched straight; the center of gravity is controlled, and the legs are perpendicular to the ground.

The purpose of this action training is to exercise the rectus abdominis, tensor fascia, and rectus femoris.

e) Lying leg crossing: Action essentials: they need to bend their knees, close their legs, bend their knees, straighten their legs, and repeat the same on the other leg.

The purpose of this action training is to exercise the rectus abdominis, abdominal oblique muscle, tensor fascia lata, iliopsoas, rectus femoris, and pubic muscle.

f) Straight arm prone with three-point support: Action essentials: two hands support on the ground; the toes point to the ground with the two feet apart, the knee joint straight, and the back tension, controling the center of gravity, and moving one hand forward.

The purpose of this action training is to exercise the trapezius, deltoid, erector spinae, and gluteus maximus.

g) Side elbow support hand side lift: Action essentials: side lying on the ground, one hand supports the top hip with the abdominal force, and one hand side lifts.

The purpose of this training is to exercise the rectus abdominis, the internal oblique muscle, the external oblique muscle, the tensor fascia, the rectus femoris, and the deltoid muscle.

h) Lying leg-hip raise: Action essentials: lying flat on the ground, knees and feet bend together, waist is used as the force, and upward force on the hip.

The purpose of this action training is to exercise latissimus dorsi, erector spinae, gluteus maximus, gluteus medius, and biceps femoris.

i) Side lying leg lift: Action essentials: The legs are lifted together, and then it is needed to change the direction, and use the waist as the force.

The purpose of this action training is to exercise the abdominal oblique muscle, tensor fascia lata, gluteus maximus, and iliopsoas.

j) Kneel standing side bending: Action essentials: the legs are close together, the two hands hold the head, the back of the waist bends to the left and leans down, and the back of the waist bends to the lower right.

The purpose of this action training is to exercise the external oblique muscle, the spine muscle, and the iliac rib muscle.

k) Supine side leg bending: Action essentials: The two feet are close together, the legs are bent together, the center of gravity is controlled, the knees are swung to the left, and the left and right alternate.

The purpose of this action training is to exercise the rectus abdominis, extra-abdominal oblique muscle, intra-abdominal oblique muscle, gluteus maximus, and gluteus medius

l) Supine legs hooking hip lifting: Action essentials: the knees need to bend on both legs, the it is needed to make right leg bend and place is on the left leg knee, use waist as the force, and then raise the hip top

The purpose of this exercise training is to exercise rectus abdominis, tensor fascia lata, erector spinae, gluteus maximus, gluteus medius, and biceps femoris.

III. EXPERIMENTAL PROCESS

A. *Pre-experiment*

From October to November 2017, the three-week core strength training was conducted for eight students of the Department of Society-adaption to test the impact of training content, training intensity and density on students with disabilities. The results showed that the exercise program was feasible. This process accumulates practical experience for formal trials, and timely revises and improves the basis for timely identification of the deficiencies of the original plan, so that the core strength training content and program are more completed.

B. *Formal Experiment*

1) Experimental time: December 2017 to June 2018, a total of 15 weeks.

2) Experimental location: Leshan Special Education School Track and Field and Rehabilitation Room

IV. RESEARCH RESULTS

A. *The Impact of 15 Weeks of Core Strength Training on the Physical Fitness of Students with Disabilities*

After 15 weeks of training according to the core strength training program, the body shape, function and quality indicators of the subjects changed to different degrees, and the specific qualitative changes are shown in "Table II".

TABLE II. EXPERIMENTAL RESULTS AND COMPARISON OF VARIOUS PHYSICAL INDICATORS BEFORE AND AFTER THE EXPERIMENT OF THE 14 SUBJECTS

Name	Before the experiment									After the experiment								
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Zhang **	166	49	4	40	22	25	10.57	-1.6	1.20	166.1	49.2	5	36	23	28	10.5	-1.6	1.25
Ma **	172	60.1	2	46	22	20	9.28	-5.2	1.05	172.2	60.2	4	42	22	21	9.20	-4.6	1.10
Liu *	165	50.2	5	56	19	24	8. 01	-0.1	1.00	165.2	50.2	7	54	21	26	7.93	-0.3	1.10
Xie **	154	44	3	60	22	27	11.46	-0.2	1.15	154.1	44.1	7	54	30	20	11.40	-2.0	1.20
Zhao **	167	55	3	64	12	21	11.17	-1.3	1.35	167.1	55.2	5	60	13	23	11.20	-1.4	1.40
Ren *	161	51	3	48	18	18	10.92	-0.6	0.85	161.2	51	5	46	17	18	10.80	-1.6	0.90
Shuai**	165	47	5	53	19	23	9.45	-0.3	1.00	165.2	47.2	8	52	21	25	9.41	-0.4	1.05
Xu**	164	58	10	63	13	23	9.18	-1.3	1.60	164.1	58	14	57	15	26	9.10	-1.4	1.70
Wang**	153	42	3	34	11	20	11.53	-1.6	1.05	153.2	42.5	7	35	14	22	11.42	-1.8	1.20
Zhang*	156	46	14	54	23	24	10.34	-0.2	1.50	156.1	46.2	19	52	24	26	10.20	-0.3	1.60
Chen*	162	50.2	9	44	19	20	9.35	-3.6	1.30	162.2	50.3	12	43	23	23	9.21	-3.8	1.40
Zhang*	155	48	21	54	22	27	7.07	-0.2	1.65	155.2	48.2	26	50	25	29	6.70	-0.4	1.70
Zhang**	162	48	2	38	7	18	12.22	-2.4	0.65	162.2	48.1	5	37	10	19	12.11	-2.6	0.70
Lei**	155	45.5	4	45	12	20	11.50	-1.4	1.40	155.1	45.6	9	44	13	23	11.4	-1.5	1.45

[a.] Note: 1 means height (cm), 2 means weight (kg), 3 means sit-up (time / min), 4 means quiet heart rate (b / min), 5 means prone back extension (cm), 6 means 4S fast Run (m), 7 means 50 meters (S), 8 means 30S 30 times squat, and 9 means standing long jump (m).

It can be seen from "Table II" that after 15 weeks of core strength training, the height, weight, resting heart rate, and the results of the three indicators of the subjects were all improved, but there was no significant difference before and after the experiment; Compared with the pre-experimental test results of 4s running, 50m running, 50s running, 30s 30

times squat, standing long jump, and sit-ups, the increases of the test results were large and there were significant differences. The increase of the 50-meter run and the standing long jump was greater than that of the prone back extension, and 30s 30 times squat.

B. *Through the 6-week Core Strength Training Method, the Experimental Results of 50-meter Run and Standing Long Jump Indicators Before and After Training Were Compared Within 25 Subjects*

"Table III" shows that after 25 students from the Department of Society-adaption have undergone special physical exercises of 6 weeks' core strength training, their 50-meter run and standing long jump have improved to varying degrees.

TABLE III. TEST RESULTS OF 50-METER RUN AND STANDING LONG JUMP INDICATORS BEFORE AND AFTER TRAINING

Student Name	Gender	Before Training		After Training	
		50 m (s)	*long jump (m)*	*50 m (s)*	*long jump (m)*
Liu Jiaqi	Male	9.49	1.31	9.42	1.35
Shui Biao	Male	8.05	1.35	7.92	1.45
Lei Yuqing	Female	11.50	1.40	11.41	1.45
Luo Yong	Male	11.96	1.55	11.90	1.60
Zhao Guidong	Male	11.17	1.35	11.20	1.40
Liu Chenwei	Male	9.32	1.35	9.27	1.40
Dai Shun	Male	8.55	1.30	8.57	1.35
Zhou Pengyu	Male	11.80	0.75	11.72	0.80
Zhang Dengxian	Male	12.22	0.65	12.11	0.70
Guo Jiaqin	Female	10.22	1.25	10.19	1.30
Chen Zhongbing	Male	10.10	1.25	10.00	1.30
Xu Dawei	Male	9.18	1.60	9.10	1.70
Shuai Jianxin	Male	9.45	1.00	9.41	1.05
Ren Xin	Female	10.92	0.85	10.80	0.90
Wang Peiqi	Female	11.53	1.05	11.42	1.20
Liu Jun	Male	8.01	1.00	7.93	1.10
Chen Yu	Male	9.35	1.30	9.21	1.40
Zhang Ming	Male	7.07	1.65	6.70	1.70
Zhang Xinyu	Male	10.57	1.20	10.5	1.25
Ma Guangrui	Male	9.28	1.05	9.20	1.10
Zhang Qun	Female	10.34	1.50	10.20	1.50
Xie Sule	Female	11.46	1.15	11.40	1.20
Zhang Hongyuan	Male	11.11	0.90	11.00	1.00
Yang Jiakun	Male	9.23	1.05	9.16	1.10
Yang Pengfei	Male	9.18	1.15	9.10	1.20

V. ANALYSIS AND DISCUSSION

A. *The Influence of Core Strength Training on the Body Shape of Students with Disabilities in the Department of Society-adaption*

Body shape refers to the general characteristics of the body, including the shape, structure, body shape and posture of the organ. It reflects the developmental state of the human body, the nutritional status and the function of the internal organ system. This study only used two body shape measurements of height and weight. Height refers to the vertical distance between the support surface and the apex of the human body when standing upright. It is an important indicator reflecting the development of human bones and the vertical development level of the human body during the growth and development of the human body. Weight is an indicator of the lateral development of the human body. It can reflect the comprehensive development of human bones, muscles, subcutaneous fat and internal organs to a certain extent. Human morphology takes weight as an important overall indicator of the development of the body's length, circumference, width and thickness. The results of this experiment showed that there were no significant changes in the height and weight indicators of the 15 weeks' core strength training subjects. Body weight is affected by many factors such as heredity, gender, age, diet, exercise, nutritional status, and living habits. Therefore, it is normal for body weight to not show significant changes.

B. *The Influence of Core Strength Training on the Physical Function of Students with Disabilities in the Department of Society-adaption*

1) Impact on still heart rate: From the measured data in "Table II", it can be seen that the still heart rate of the subjects did not change much, probably because there were no sophisticated testing equipments, and the students of the special school Department of Society-adaption did not cooperate with the test for their own reasons. Still heart rate mainly reflects the function of a person's cardiovascular system.

2) Impact on 30s 30 times squat: The significance of the test on 30s 30 times squat is it can reflect the cardiovascular function of the human body. It has a range of values, when X<0 is excellent, X=1-5 is good, X=6-10 is medium, X=11-15 is lower, X>16 is bad. However, after testing the 14 subjects of the Department of Society-adaption, their data were reflected as excellent. The scientific nature of this test result still needs to be studied, but the impact of physical training, teaching, and rehabilitation through the 15-week core strength training method on their indicators is still changing.

C. *The Influence of Core Strength Training on the Physical Quality of Students with Disabilities in the Department of Society-adaption*

Physical quality, also known as physical fitness, refers to the general function of the body's ability to express strength, speed, endurance, flexibility, sensitivity, coordination and balance during exercise. It is a comprehensive reflection of the functions of various organ systems in the muscle work. The study used physical fitness of 5 test indicators of 4s fast run (m), standing long jump (m), prone back extension (cm), 1min sit-up (time / min), and 50m sprint (s).

1) Impact on 1min sit-up: This indicator mainly reflects the abdominal muscle strength and endurance strength of the practitioner. After the experiment, the average number of sit-ups for 14 students increased by 1.2, which was the largest increase among all indicators. The reason is that the sit-up performance depends mainly on the strength of the core area of the practitioner, while the core strength exercise is to train the upper muscle layer and the deep small muscle group in the core area. The exercise structure is the same or similar to the sit-up. As a result, the results of sit-ups have been improved immediately.

2) Impact on 4s fast run: The 4s fast run is also a test indicator that reflects the subject's ability to run fast. The longer the tester runs in 4s, the stronger the tester's ability to run quickly. From the data in Table 1, it can be seen that the distance between the 14 students of the Department of Society-adaption is greatly improved. Among them, Zhang Ming’s scores have increased from 27 meters to 29 meters, which has achieved the results achieved by normal students.

3) Impact on standing long jump: This indicator mainly reflects the explosive power of the lower limbs of the practitioner and the ability to control the body during the vacating process, the ability to connect the upper and lower limbs, and the ability to coordinate the muscles. After the experiment, the average number of 25 students increased by 0.30 meters, and there was a significant change before and after the experiment. This is because the standing long jump is the movement of the main lower limb as the last point of force, and the participation of the upper limb and the waist and the abdomen is required. The degree of participation mainly depends on the control of the core part. Although the core strength does not participate in the direct completion of the action, it plays a stable pivotal role in the force of the limbs, which can better complete the transmission and integration of power. Coupled with good core strength to improve the body's control, balance and coordination of upper and lower limbs in an unstable state, the standing long jump performance has been significantly improved.

4) Impact on prone back extension: Prone back extension mainly reflects the stretching ability of the subject's trunk and neck. The greater the measurement of the prone extension, the better the tester's ability to stretch the trunk and neck. After the experiment, the average number of prone extensions of the 14 students increased by 2.2 cm. The reason is that the performance of prone stretching depends mainly on the strength of the core area of the practitioner, while the core strength training method is to train the strength of the superficial muscles and deep muscles in the core area. And there are similarities in the action structure of the exercise and prone back extension, so the performance of prone back extension is improved.

5) Impact on the 50m sprint: The 50m sprint mainly reflects the subject's ability to run quickly. From Tables 1 and 2, it can be seen that through the practice of the core strength training method, the subjects' performance has improved through the 6-week core strength training. For the 25 students in the Department of Society-adaption who were in the 6-week core strength training, their 50-meter running average scores increased by 0.1s. This explains that the core strength training method can improve the athletic performance of students in the special education school and improve their fast running ability.

VI. CONCLUSION AND SUGGESTIONS

A. *Conclusion*

The core strength training lasting 15 weeks can improve the physical fitness of disabled (society-adaption) students. Core strength training can improve the athletic performance of disabled (society-adaption) students, as well as improve movement disorders and emotional disorders during core strength training. Through the strengthening of the muscle strength of the core area of the body, the strength of the distal muscle group can be improved, and the movement disorder of the special school disabled (society-adaption) students can be effectively improved. Therefore, the use of core strength concepts and methods is essential in daily special physical education, training and rehabilitation.

B. *Suggestions*

- Core strength training is a training method that has been widely concerned in the field of competitive sports. Basically, there is no research in the special sports field of special education schools. It is hoped that future researchers will pay more attention to improving the physical health of disabled students and improve the role of movement disorders.
- The influence of core strength exercises on the physical fitness of students with disabilities is multi-

faceted. This thesis only conducts experimental research on the nine indicators of physical fitness and function of the students of the disabled students in the Department of Society-adaption, hoping that it can be continued to carry out further in-depth research from more angles in the future.

- In carrying out the special physical education content similar to the core strength practice, the developmental characteristics of the disabled students and the development of physical fitness, the types of obstacles and things like that should be fully considered. The teaching methods should be diversified to adapt to the students' psychology at the spiritual and moral level. The atmosphere needs to be active, pleasant and relaxed. It can be taught in the form of games or small competitions to stimulate students' interest, enthusiasm and initiative.

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