Sports Medicine and Rehabilitation Journal

Research Article
Published: 29 Feb, 2019

The Effect of the Lower Limb Balance on the Athletic Ability of Classical Wrestlers

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Abstract

Objective: To understand the basic characteristics of the balance ability of classical wrestlers by measuring the balance of lower limbs balance in wrestling and to understand the influence of balance ability on the athletic ability of classical wrestlers, and to analyze the influencing factors of the development of balance ability. The training of wrestlers provides a certain reference.

Methods: Twenty seven professional classical wrestlers from Wuhan Sport University were selected as research objects. Each subject was tested for one-leg weight standing ability and dynamic balance ability, and tests for thigh circumference, lower limb muscle strength, and body composition. The literature data method, expert interview method, sports test method and data statistics method are used to analyze the influencing factors of wrestlers' balance ability. Finally, the influence of the classical wrestler's lower limb balance ability on motor skills is analyzed.

Results:

1. There was a significant difference in the standing time of one leg between the two groups ($p<0.05$).
2. There was a significant difference between the two groups in dynamic balance ability ($p<0.05$).
3. There was a significant correlation between dynamic balance ability and exercise capacity ($p<0.05$).
4. The dynamic balance ability was correlated with thigh circumference, lower limb muscle strength and body composition ($p<0.05$).

Conclusion:

1. The wrestlers of the same level have good balance ability and strong exercise ability.
2. Wrestlers of the same level have strong one-legged weight and better sports performance.
3. The push and pull of the upper limbs are positively correlated with the athletic ability of the classical wrestlers.

Keywords: Classical wrestling; Balance ability; Athletic ability

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Received Date: *04 Dec 2018*
Accepted Date: *25 Feb 2019*
Published Date: *29 Feb 2019*

Citation:
Zheng P, Dong Y, Wang M. The Effect of the Lower Limb Balance on the Athletic Ability of Classical Wrestlers. Sports Med Rehabil J. 2019; 4(1): 1045.

Introduction

Classical wrestling is not only a sport that requires a high level of strength, but also a higher demand for the balance of the lower limbs [1]. The best way for an attacker to get a higher score is to drop the opponent to the ground. This requires breaking the opponent's body balance. However, once the balance is destroyed, the stability of the body is gone and the game is in danger situation. During the game, the attacker not only needs to maintain the dynamic balance in the wrestling process, but also maintains the instantaneous static balance under a load when the opponent falls to the ground [2], which has the balance of the lower limbs of the wrestler a higher requirement. Therefore, more and more coaches continue to strengthen the balance of training in the process of training athletes. The balance of the human body is a special state of motion, including static stability under relatively static and dynamic coordination under motion. Balance is also a basic function of the human body. It requires the close integration of the human body's sensory input, central integration, and motion control to maintain the balance of the human body [3]. At the same time, balance is the basis for other actions, only in a state of balance. In order to show more skilled and accurate movements. Therefore, through the study of the balance ability and sports skills of wrestlers, it can provide reference for the classical wrestlers in their usual training.

Table 1: Basic information distribution table of athletes.

Group	n	Age (year)	Height (cm)	Body weight (kg)
The first group	12	17.17 ± 8.78	175.67 ± 8.78	73.91 ± 16.71
The second group	12	16.67 ± 1.23	175.66 ± 5.96	77.29 ± 11.93

Table 2: Dynamic balance data analysis.

	Group	n	$\bar{x} \pm s$	Standard Error of Mean	p
DBS	1	12	30365.25 ± 4163.27	1201.83	0.02
	2	12	25225.42 ± 5322.95	1536.6	
DBL	1	12	1.63 ± 0.58329	0.168	0.02
	2	12	2.35 ± 0.76217	0.22	

Research Objects and Methods

Research objects

Twenty four classical wrestlers from Wuhan Sports University of Hubei Province were selected. The specific information of athletes is shown in Table 1.

Research methods

Literature method: In order to grasp and understand the results of this research in a deeper level, the literatures are reviewed and collected in the libraries of China Knowledge Network, Wanfang Database, Weipu Network and Wuhan Sports Institute, and the "wrestling movement" and "lower limb balance ability", "Sports ability" and other search for keywords, a total of more than twenty related literatures and periodicals, combined with physical therapy, kinematics and other books to provide a more reliable theoretical basis for this study.

Expert interview method: Through a visit to the teachers of the Health Science of Wuhan Sport University, we can learn about the balance and the professional knowledge related to the balance ability, as well as the design ideas and test indicators of the research, so as to get a more accurate and more responsive test method. At the same time, the coaches of classical wrestlers are also familiar with the knowledge of wrestling and interviews with athletes.

Sports test method

Test indicators: The test includes the athlete's dynamic balance ability, the time of standing upright single leg, body composition, the force of pushing and pulling the left and right upper limbs, the left and right lower limbs, and the circumference of the lower and lower extremities.

Test method: Before conducting the test, the tester is required to perform a warm-up activity of 5 mins to 10 mins, and then prepare according to different tests. Before each test, the corresponding personnel will perform the demonstration of the standard action and then test by the remote mobilize [4]. During the test, the tester is required to concentrate and carefully complete each test.

1. Upright single leg weight-bearing time: The tester stands on one leg, the other leg is raised about 10 cm to 20 cm, the body is upright, and each hand holds a 10 kg barbell piece. After completion, the side leg is tested and recorded time.

2. Left and right lower limb strength: The tester is seated, the legs are flexed, the hands are supported on both sides, and the two legs are forced out at the same time to record the strength on both sides.

3. Push up the upper limbs: The tester is seated, the upper body is upright, and both hands push the instrument lever upwards to record the weight displayed by the instrument.

4. Upper limb strength pull-down: The tester is seated, the upper body is upright, and both hands pull the instrument rod at the same time, and the instrument displays the force.

5. Dynamic balance test: The tester first stands on the instrument. Before the instrument is formally tested, the tester has a preparation time of ten seconds [5]. After the start, the hands can't support the object, the body's center of gravity is controlled, and the balance of the minute is recorded.

6. Left and right thigh circumference: The circumference was measured at a position of 10 cm on the tibia of the test subject using a tape measure, and the result was recorded.

7. Using a specialized body composition test instrument: The tester only needs to input his or her own name, age, weight and height, and the body composition of the body can be measured by selecting according to the tester's prompt.

Data statistics: In this study, the data collected and collated were statistically analyzed. SPSS10.0 software package and Excel were used for data processing. Principal component analysis, correlation analysis, independent sample t test and other statistical methods were used to the impact of lower limb balance ability on motor skills. The correlation between body composition and lower limb muscle strength was analyzed. P>0.05 was expressed as no significant difference, and P<0.05 was expressed as significant difference.

Table 3: Single-leg load data analysis.

	Group	N	$\bar{x} \pm s$	Standard Error of Mean	p
Left lower limb standing time/s	1	12	216.83 ± 56.897	16.425	0.02
	2	12	154.25 ± 61.202	17.667	
Right lower limb standing time/s	1	12	228.58 ± 73.805	21.306	0.01
	2	12	149.50 ± 57.448	16.584	

Table 4: Analysis of lower extremity muscle strength.

	Group	n	$\bar{x} \pm s$	Standard Error of Mean	p	Pearson Correlation
Left leg strength/N	1	12	233.83 ± 27.87	8.04423	1	0.729**
	2	12	234.46 ± 19.04	5.49775		
Right leg strength/N	1	12	226.04 ± 32.53	9.39101	0.8	
	2	12	229.00 ± 16.95	4.89395		

Research Results and Analysis

According to the performance and comprehensive factors of the athletes, the coach divides them into the first group with the strong ability and the second group with the poor ability. Analysis of the dynamic balance scores of the two groups (Table 2).

Dynamic balance ability related data analysis

Table 2 shows the distribution of the mean and standard deviation of the dynamic balance ability score and the dynamic balance grade between the two groups. Dynamic balance test is an important indicator of human dynamic balance ability. The dynamic balance score is obtained by giving the tester a one-minute dynamic balance test. The average score of the members is selected as the effective score for each group. From Table 2, the first group of dynamic balance scores is the first group x ± s> the second group x ± s, the dynamic balance level is the first group x ± s< the second group x ± s, and the dynamic balance score indicates that the higher the score is balanced The better the ability, the lower the value of the dynamic balance level means the better the dynamic ability. The dynamic balance score of the first group and the second group p=0.015<0.05, there was a significant difference, the dynamic balance level between the first group and the second group p=0.016<0.05, there was a significant difference, so the lower limb dynamic balance ability and There are differences in athletic ability. The ability of the first group is indeed better than the second group.

Analysis of standing time of one-legged weight

Table 3 shows the distribution of standing time of three groups of single-leg weights of 10 kg. One-legged standing time is an important indicator of a person's static balance ability. The average score of each group of testers is selected as the effective score of the group [6]. From the table, the value of the standing weight time x ± s of each group of left and right feet is known, and the first group > the second group. Using the independent sample t test to analyze the data of the standing time of the two groups of one foot, it can be seen that there is a significant difference between the first group and the second group p=0.017<0.05. On the right side, the first group standing time and the second group p=0.008<0.05, there was a significant difference, indicating that there was a difference in the weight-bearing time and exercise capacity of the single leg.

Therefore, the static balance ability of wrestling and mobilization should also be strengthened during exercise. The static balance ability also plays a vital role in the athletic ability of the classical wrestlers. When the wrestlers touch the body, they will fall to the ground again. Instantly destroys the static balance of the other party, or when the opponent falls, there will be a single leg supporting the weight. According to the principle of biomechanics, as the body tilts, the arm is shortened, the force on the single leg is increased, and it is 4 to 5 times the weight of the person [7]. It requires not only strong muscle strength, but also certain balance stability.

Analysis of muscle strength in lower limbs

From Table 4, it can be seen that the two groups had p>0.05 on the left knee strength, and there was no difference. There was no difference in the right knee strength between the two groups, indicating no difference in lower limb strength and exercise capacity. However, when the two groups were combined, the Pearson correlation coefficient analysis was performed on the left and right knee flexion muscles. The correlation coefficient between the knee strength of the left lower extremity and the knee extension force of the right lower extremity is 0.729, and their p<0.01 is less than the theoretically significant difference level of 0.01, indicating that the correlation coefficient is not caused by accidental factors, and has significant difference and strong. The relevant level indicates that there is a positive correlation between the strength of the left leg and the knee strength of the classical wrestler.

Correlation analysis of lower extremity thigh circumference

From Table 5, the left lower extremity thigh circumference between the two groups was p>0.05, which was not statistically significant. The right lower extremity thigh circumference was p>0.05 between the two groups, and there was no difference between the two groups. Therefore, it cannot be said that the exercise capacity is affected by the thigh circumference and may also be affected by factors such as lower body fat loss and body weight. Therefore, in the training, it is not only necessary to increase the thigh circumference to improve the exercise capacity, but should comprehensively consider the influence of various factors.

Comprehensive correlation analysis of lower extremity thigh circumference, strength, fat free soft body weight

Table 6 shows the correlation analysis of athletes' lower extremity

Table 5: Two groups of left and right thigh circumference distribution.

	Group	n	$\bar{x}$ ± s	Standard error of mean	p
Left leg circumference	1	12	47.67 ± 4.01	1.017	0.5
	2	12	48.58 ±3.60	1.04	
Right leg circumference	1	12	47.50 ± 4.01	1.158	0.4
	2	12	48.75 ± 3.33	0.962	

Table 6: Correlation analysis of comprehensive correlation analysis of lower extremity thigh circumference, strength, fat free soft body weight.

		LLC	RLC	LLS	RLS	LLFSW	RLFSW
LLC	Pearson Correlation	1	0.943**	0.156	0.288	0.736**	0.750**
RLC	Pearson Correlation	0.943**	1	0.142	0.356	0.733**	0.734**
LLS	Pearson Correlation	0.156	0.142	1	0.729**	0.166	0.195
RLS	Pearson Correlation	0.288	0.356	0.729**	1	0.186	0.182
LLFSW	Pearson Correlation	0.736**	0.733**	0.166	0.186	1	0.995**
RLFSW	Pearson Correlation	0.750**	0.734**	0.195	0.182	0.995**	1

**-Significantly correlated at 0.01 levels (both sides) LLC: Left Leg Circumference; RLC: Right Leg Circumference; LLS: Left Leg Strength; RLS: Right Leg Strength; LLFSW: Left Lower Extremity to Fat Soft Weight; RLFSW: Right Lower Extremity to Fat Soft Weight

Table 7: Body mass index analysis.

Model	R	R^2	Adjust R^2	Standard Estimated Error
1	0.744[a]	0.553	0.511	2.094

Table 8: Variability body mass index analysis[a]

Model	Sum of Square	df	Mean Square	F	Sig.
Return	114.063	2	57.031	13.01	0.000[b]
Residual	92.082	21	4.385		
Total	206.145	23			

a. Dependent variable: Body Mass Index
b. Prediction variable: (constant) the right lower limb fat-free soft weight, the left lower limb fat-free soft weight.

Table 9: Upper limb push and pull analysis.

	Group	N	$\bar{x} \pm s$	Standard Error of Mean	p
Push	1	12	58.08 ± 11.38	3.286	0.16
	2	12	63.58 ± 6.19	1.786	
Pull	1	12	89.08 ± 14.98	4.325	0.42
	2	12	93.91 ± 13.47	3.888	

thigh circumference, strength, and lower limb de-fat software. Using Pearson correlation analysis for data processing, we can see that the left thigh circumference and thigh strength, right thigh circumference and right thigh strength are related. They were 0.156 and 0.356, respectively, but the p values were all greater than 0.05, which was not statistically significant. Therefore, there is no correlation between the thigh circumference and the thigh strength. Therefore, for the classical wrestlers, the thigh circumference cannot be used to measure the strength of the thigh of the lower limb.

Correlation analysis of body mass index

Tables 7 and 8 show the body mass index analysis. Regression analysis of the data shows that the R^2 provides the regression variation, which shows that the left and right lower limbs lose fat and soft body to predict the body mass index with 51.1% explanatory power [8], $F(2,21)=13.006$, $p=0.000$, indicating that the explanatory power is statistically significant. It shows that under certain circumstances, the lower limbs to lose fat and soft weight have an effect on BMI, so wrestlers should also pay attention to the development of lower limb muscles during training.

Analysis of upper limb push and pull

Table 9 is a table for analyzing the tension and thrust of the upper limbs. The independent sample t-test was used to analyze the significant difference between the upper limb tensile force and the thrust. The upper limb thrust p value between the two groups was 0.156 and 0.05, no significant difference. The p-value of upper limb pull force was 0.415 and 0.05 respectively, and there was no significant difference, indicating that there was no significant difference in upper limb pull force, thrust and exercise ability. Therefore, the wrestling athlete's upper limb strength could not be compared to measure the athlete's exercise ability, but should be considered comprehensively [9]. However, the importance of the strength of the upper limbs in wrestling athletes cannot be ignored. In order to get better results, some athletes generally use the torsion of the trunk while using the torso of the torso and the upper limbs as the arm. As a fulcrum, the sudden pull of the upper limbs is used as the power, and the defensive torque is equal to the pulling force of the upper limb multiplied by the total arm length [10,11], so as to force the opponent to fall over, and in this case, it is easy to keep yourself stable so that the score will increase significantly [12].

Dynamic balance ability and body composition

Table 10 shows the correlation analysis between dynamic balance ability and body composition. Pearson correlation analysis is performed on the collected data. The table shows the dynamic balance score and left leg circumference, right leg circumference, left lower limb de-fat soft body weight. The correlation between fat weight, body mass index, body mass percentage, fat weight, basal metabolic rate, and body fat loss and soft body weight of the right lower extremity were 0.547, 0.533, 0.432, 0.446, 0.502, 0.470, 0.500, 0.481, and 0.451, respectively. The p values were 0.006, 0.005, 0.035, 0.029, 0.012, 0.020, 0.013, 0.017, and 0.027, all of which were less than 0.05, with significant differences. There is also a strong correlation between the dynamic balance level and the above body composition, thus indicating that the balance ability of wrestling exercise has a strong correlation with body composition. Athletes need to regularly monitor the body composition indicators while developing their balance skills during training [13,14]. The above body composition mainly studies the indicators of fat, so it can only show that wrestlers should properly control the body fat content. According to the analysis of exercise physiology [15], wrestlers mainly perform anaerobic exercise during the competition, and some participate in aerobic exercise. When energizing, they need to rely on glycolysis and oxidation of sugar, so the release function is less, and the controlling of fat content is also a major concern for wrestlers.

Conclusion

This experiment studied the different abilities of wrestlers, and also analyzed the influence of different factors in the group, and reached the following conclusions:

1. Differences in the dynamic balance of the lower limbs do have differences in exercise capacity. But it is also affected by the muscle strength of the lower limbs.

2. The length of one-legged standing time is related to exercise ability, and there is also a certain correlation with the fat-removing weight of the lower limbs.

3. There is a positive correlation between the muscle strength of the left and right lower limbs of the classical wrestlers, but there is no correlation between the muscle strength and the soft weight of the lower limbs.

Table 10: Analysis of dynamic balance ability and body composition correlation.

		DBS	DBL	LLC	RLC	RLFSW	LLFSW	BMI	PP	Fat weight	BMR	TFSW
DBS	Pearson Correlation	1	-0.999**	-0.547**	-0.553**	-0.432*	-0.446*	-0.502*	-0.470*	-0.500*	-0.481*	-0.451*
DBL	Pearson Correlation	-0.999**	1	0.527**	0.536**	0.426*	0.441*	0.488*	0.456*	0.485*	0.476*	0.446*

**-Significantly correlated at the 0.01 level (both sides)
*-Significantly correlated at the 0.05 level (both sides)
BMI: Body Mass Index; PP: Physique Percentage; BMR: Basal Metabolic Rate; TFSW: Trunk Fat-Free Soft Weight

4. The dynamic balance ability is positively correlated with the static balance ability, suggesting that the training cannot be ignored when the wrestlers are training.

5. There is a positive correlation between the upper limb thrust, pulling force and athletic ability of wrestlers of the same magnitude. It is necessary to pay attention to the development of the upper limb muscle strength.

Recommendations

Through the data analysis of the dynamic balance ability, static balance ability, muscle strength, body composition and other indicators of twenty four classical wrestlers, comprehensive evaluation of balance ability has certain influence on the score, but good lower limb balance ability also needs certain strength. The support also needs to be maintained from the vestibular receptors, visual compensation, proprioceptive input, and the central nervous system's acceptance signal and regulation [16]. In the maintenance of balance, the three joints of the hips, knees and ankles of the lower limbs also play a considerable role. The muscles and ligaments around the joints are important structures for maintaining the joints. Similarly, the different angles of the joints of the human body have a certain influence on the stability of the body. Especially for the wrestlers, the angle of the knee joint needs a certain amount of control, which can lower the center of gravity and contribute to the stability of the body [17]. The coach should formulate a balanced training plan according to the personal physical condition and actual situation of the wrestler and combine other strength training to improve the athlete's athletic ability. At the same time, attention should be paid to balance as a factor affecting motor skills, taking into account the influence of other factors. For example, after a period of time to test the athlete's body fat, the strength of the upper and lower limbs, the body's nutritional status and other indicators. In the future research can focus on the impact of training balance on wrestlers.

References

1. Zhihai Wang. Research on the Training and Evaluation of the Physical Ability of Classical Wrestlers--Taking the Classical Wrestling Team of Weifang City Sports School as an Example [D]. Shandong Sports University Master's Thesis. 2011
2. Dvorkin LS, Men'shikov AI, Ivanov II. Developing explosive power in high-intensity weight-bearing training of elite classical wrestlers. J Capital Inst Physical Education. 2012;24(5):385-8.
3. Baonian Li. A Brief Discussion on the Relationship between Sports Biomechanics and Wrestling Technical Movements [J]. Guizhou Sports Technology. 2007(3):53-4.
4. Jianshe li, Nan Jiang, Yanfeng Li. The relationship between male wrestler's arch and balance, jumping ability. Journal of Capital Institute of Physical Education. 2007;19(3):62-4.
5. Hui Yu. Experimental Research on Physical Fitness Training of Inner Mongolia Men's Classical Wrestling Team[D]. Beijing Sport University. 2013.
6. Zhihai Wang. Research on the Training and Evaluation of the Physical Ability of Classical Wrestlers [D]. Shandong Sports University. 2011.
7. Guohua Wang. Study on the Effect of Body Balance Ability on Freestyle Performance of 8 ~ 12 Years Old Athletes [J]. Contemporary Sports Science and Technology. 2012;2(20):14-5.
8. Xuejun Zhang, Shu Liu, Lincui Guo. Study on Muscle Strength Characteristics of Main Joints of Chinese Classical Wrestlers [J]. Sports Science. 2004;24(6):25-8.
9. Xiusen Yang. Research on the Relationship between Competition Winning and Strength and Endurance Training of Elite Classical Wrestlers [D]. Shandong Sports University. 2013.
10. YunPeng Zhi. A study on the correlation between the development of basic motor skills and the ability of static balance in children aged 3-6 years [D]. Shandong Normal University. 2017.
11. Yoo S, Park SK, Yoon S. Comparison of Proprioceptive Training and Muscular Strength Training to Improve Balance Ability of Taekwondo Poomsae Athletes: A Randomized Controlled Trials. J Sports Sci Med. 2018;17(3):445-54.
12. Kachouri H, Borji R, Baccouch R, Laatar R, Rebai H, Sahli S. The effect of a combined strength and proprioceptive training on muscle strength and postural balance in boys with intellectual disability: An exploratory study. Res Dev Disabil. 2016;53-54:367-76.
13. Hongping Zhang. Research on the Effect of Balance Training on the Achievement of Juvenile Shot Putters [J]. CAI ZHI, 2015;28.
14. Yongjun Gao. Discussion on the Training of Teenagers' Wrestling [C]// Western Sports Research. 2016.
15. Liang Zhao. Research on Training Characteristics of Chinese Classical Wrestlers in Special Training Stage [D]. Shandong Sports University. 2011.
16. Wei Li, Dongsen Liu, Yian Tang. The Static Balance Ability of Chinese Individual Figure Skating Men's Single Skaters [J]. Journal of Shenyang Sport University. 2012;31(3):120-2.
17. Chen Qin, Yi Li. Effective analysis of balance ability training of elite table tennis players [J]. Contemporary Sports Science and Technology. 2013;3(10):31.