

# Analysis Techniques of Women's 20Km Walking on the Asian Games

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## Abstract:

With the continuous innovation of scientific and technological means, the scientificization of sports training is becoming more and more perfect, China's race walk has now basically reached the top level, however, there is still a certain gap with Europe and the United States. Yang Jiayu, Qie Yangshi sister as the Asian Games women's 20 km race runner-up, is the main athlete of the 2022 Tokyo Olympic Games, although Yang Jiayu won the Asian Games, but there is still a phenomenon of empty fouls, indicating that there are still some technical problems. In order to understand the shortcomings and shortcomings in the sports, Yang Jiayu and Qieyangshi sister technology, and further improve the technical action, this paper to the 2018 Asian Games runner-up as the test object, through the literature method, image analysis method, comparative analysis method and data statistics, To participate in the 2018 Asian Games women's 20km race runner-up's race walking technology research and analysis, their technical characteristics and the famous Russian athlete Kodeyapkina comparative analysis, in order to show the advantages and weaknesses of china's two athletes, so that Yang Jiayu reduce fouls, At the same time, china's two athletes have better race walking technology to participate in domestic and foreign competitions.

**Keywords:** 20Km Women's Walker, Race Walking techniques.

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## I. INTRODUCTION

The race walking project has always been China's dominant traditional project. Yang Jiayu and Qieyang Shijie are the runners-up of the women's 20-kilometer race in the Asian Games. They are the main players of the 2022 Tokyo Olympics. Although Yang Jiayu won the Asian Games championship, it still appeared once. The phenomenon of flying fouls indicates that there are still certain problems in technology. In order to understand the shortcomings of Yang Jiayu and Qieyang Shijie in the process of sports, and further improve the technical movements, this article takes the 2018 Asian Games championship and runner-up as the test object, and their technical characteristics and the famous Russian athlete Cod Yapkina made a comparison to find out the advantages and disadvantages of the two athletes in China, so that Yang Jiayu reduced the foul, and at the same time, the two athletes in China had better walking skills to participate in domestic and international competitions.

## II. MATERIALS AND METHODS

After the race is listed as the official competition of the Olympic Games, the race walking technology has been continuously improved and developed. At present, the walking technique is based on the vertical rotation of the pelvis around the body, the amplitude is moderate, the stride is moderate, the movement is natural, and the frequency is high. This paper analyzes the existing theoretical research, comprehensively analyzes the women's 20km crown and runner-up skills in this Asian Games, and studies the athletes' sports performance, which provides an important theoretical basis for the athletes' competition.

### 2.1 Materials and Methods

#### 2.1.1 Materials

Taking the 2018 Asian Games championship and runner-up walking techniques as the research object, they studied their game technology. In addition, a comparative analysis was conducted on the individual technical indicators of the Russian athletes Cordia Pukea, who participated in the IAAF Race Walking Challenge in 2014. The basic situation of the test object is shown in Table 1.

Table 1 Basic Information Table for the Champions and Runners of the 2018 Asian Games

Name	Date of birth	Height/cm	Weight/kg	Item	GR	PB
Yang Jiayu	1996.2.18	162	45	Women's 20km Race	1:29:15	1:26:18
Qie Yang Shijie	1990.11.11	160	47	Women's 20km Race	1:29:15	1:25:16

Table 2 Reference Object Basic Information Table

Name	Date of birth	Height/cm	Weight/kg	Item	GR	PB
Kodaya Pugina	1989.10.23	170	48	Women's 20km Race	1:26:31	1:25:09

#### 2.1.2 Research Methods

Documentary Law. According to the needs of this research, I Qiecked China Knowledge Network and searQied 102 articles with the words "women's walking, technology", and carefully studied 15 journals or papers on walking techniques. At the same time, I reviewed many books in the Capital Institute of Physical Education. The monograph on track and field in the track and field theory course, with reference to "Advanced Courses in Track and Field Sports" and "Advanced Courses in Modern Athletics Training", comprehensively collect and sort out the data and materials about walking. Through a detailed reading of the official website of the Asian Games, the basic information of the championship and runner-up and the results of the competition were searQied.

Image Analysis. Pisaca image processing software and Dartfish image processing software were used to calibrate and analyze the important technical links in the captured video. For the technical action of the high-speed (5th, 7th lap) of the crown and runner-up, select a step-by-step motion video to obtain the

original data, and analyze the parameters such as the distance and angle required by the paper.

**Comparative Analysis.** Taking the famous Russian athlete Codaya Pugina in 2014 as a reference, compare the results of the women's 20km race and runner-up in the 2018 Asian Games, select the video of the athletes' high-speed competition, and analyze the skills of the athletes' competition. The differences and shortcomings between Chinese athletes and other top athletes in the world provide an important basis for improving technology in the future.

**Mathematical Statistics.** Use EXCEL2007 software to sort out the technical data (step size, stride frequency, joint angle, etc.) of the walking athletes in the literature.

### III. CONCLUSION

#### 3.1 Definition of Race Walking Technology and Its Stage Division

The latest definition of the 2013 IAAF Article 230 is that the race is a way for athletes to keep walking with the ground by walking with their feet, without visible (human eyes). The front legs should be straight from the moment the foot touches the ground to the vertical (ie the knee joint must not bend) [1-4].

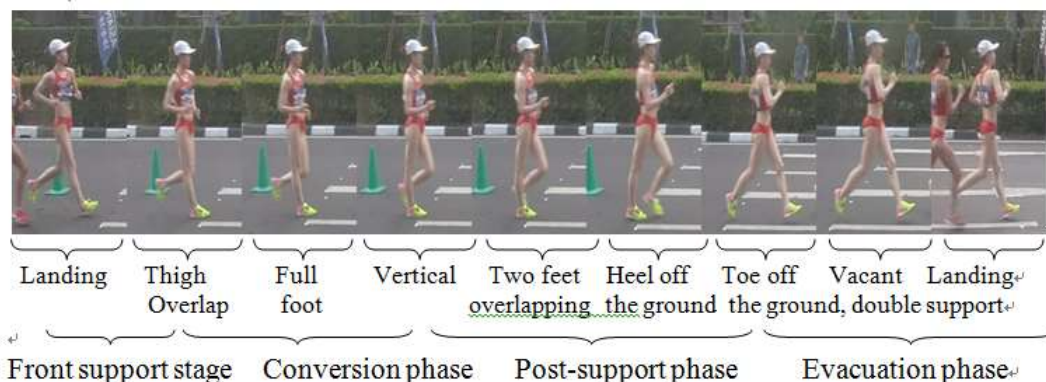


Fig. 1 Yang Jiayu Complete Re-step Diagram

As shown in Fig. 1, the winner of the competition, Yang Jiayu's 20-kilometer walk-through complete re-stepping diagram, includes the left single-step period and the right-single-step period in the whole re-step. In this cycle of kinematics theory, the walking technique can be divided into front support. Stage, conversion stage, post-support stage, and vacant stage. The double support is a technical phenomenon that the front swing and the moment of the moment are in contact with the ground at the same time, and should not be regarded as a technical stage.

### 3.2 Change and Analysis of Linear Indicators of Walking Race

#### 3.2.1 Step Size and Step Frequency Analysis.

The step size and the step frequency directly affect the athlete's walking performance, and the two are mutually restrictive and mutually influential. Therefore, this paper combines the step size and the step frequency to study. As shown in Table 3, in the high-speed process of the two athletes in the crown and runner-up, in the comparison of the step size, the right foot length of Qieyang Shijie is greater than that of Yang Jiayu's right foot step by 4 cm; in the balance of the left and right balance of the step, Yang Jiayu The step size is basically balanced, only 1 cm difference, and the left foot step of Qieyang Shijie is 3 cm shorter than the right foot step. From these data, it can be seen that the balance of the two athletes in single step or left foot length. In the sexual comparison, there is a big gap with the world's top athletes, which in turn affects the normative nature of their race walking skills. From the ratio of step height to height, Yang Jiayu's left foot length ratio is 0.66, and the right foot step height ratio is 0.654, which is significantly lower than the Cordia Pukena's step height ratio; Qie Yang's left leg step The height ratio is 0.669, and the right leg step height ratio is 0.688. The step height ratio of the right leg is exactly the same as that of Cordia Pukea. This shows that Yang Jiayu's step size is obviously insufficient, and there is a certain gap between the top athletes. Improve hip flexibility and coordination.

Table 3 Step Size, Step Frequency, Head Fluctuation Distance Statistics

Index Name	Step size /m		Repeat step frequency /min	Step/height ratio		Head undulation /cm
	Left	Right		Left	Right	
Yang Jiayu	1.07	1.06	219.2	0.660	0.654	12
Qie Yang Shijie	1.07	1.10	213.1	0.669	0.688	10
Kodaya Pugina	1.17	1.17	208.7	0.688	0.688	8.5

In terms of step frequency, it can be clearly seen that Yang Jiayu's average repeating step frequency is 219.2 steps/min, which is 10.5 steps faster than Codya Pukina every minute. The average stepping frequency of Qieyang Shijie is 213.1 steps/min. Becker Pukeina is 4.4 steps per minute. It can be seen that the pace style of two athletes in China is "fast frequency". From the individual athletes, Yang Jiayu's left single step frequency is 220.3 steps per minute, the right single step frequency is 218.2 steps per minute, and the left leg step frequency is 2.1 steps faster than the right leg step frequency; The single step frequency is 210.2 steps per minute, the right single step frequency is 216.1 steps per minute, the left leg frequency is 5.9 steps slower than the right leg frequency, and the difference between the two steps is large, indicating that the left and right footstep frequencies are unstable. Sex. In the high-speed process, the instability of the left and right legs is a key factor affecting the performance of the walking. Qie Yang Shijie left and right legs are unstable, which greatly reflects the lack of flexibility of the hip joint, which causes the ups and downs of the body's center of gravity and the forward linear motion of the body. Therefore, it is recommended to adjust the step frequency and step size to a suitable range during training, combined with the characteristics of the individuality, to exert the best technology and achieve the best

results [3,4].

### 3.2.2 Head Undulation Distance Analysis.

In the race walking competition, the referee judges whether the athlete has a vacancy phenomenon by observing the undulation height of the athlete's head. From the data of the head undulation distance in Table 3, it can be seen that Yang Jiayu's head undulation distance is 12cm, which is 3.5cm larger than the head undulation of Codaya Pujina [4], and the head undulation distance of Qieyang Shijie is 10cm. Bickey Pukina's head is 1.5cm high and the head is relatively flat. However, the height of both athletes in China is lower than that of Cordia Pugina, but the head undulation is greater than the Corda Na, indicating that the greater the center of gravity of the athletes, the more obvious the vacancy phenomenon, which is one of the main factors affecting Yang Jiayu's foul.

### 3.3 Change and Analysis of the Angle Indicators of the Walking Movement

#### 3.3.1 Analysis of the Athlete's Heel Angle.

The so-called posterior humerus angle is: the angle formed by the athlete's body's center of gravity moving forward and the squatting leg from the ground. As can be seen from Fig.2, Yang Jiayu's left leg squat angle is 47.7°, the right leg squat angle is 38.4°; Qieyang Shijie's left leg squat angle is 46.8°, and the right leg squat angle is 44.2°. It is obvious from the comparison that Yang Jiayu's left and right legs are unbalanced, which causes the body's center of gravity to fluctuate too much. However, the angles of the left and right legs of Qieyang Shijie are basically the same, indicating that the legs are more relaxed. The greater the angle of the posterior iliac crest, the faster the center of gravity of the body moves forward. The stronger the ability to move continuously, the less physical energy the body consumes, but the angle of the breech should be within a reasonable range, not for the high speed. Too much pursuit of the angle of departure, so that the body center of gravity is too large, easy to produce vacancy, fouling [5].

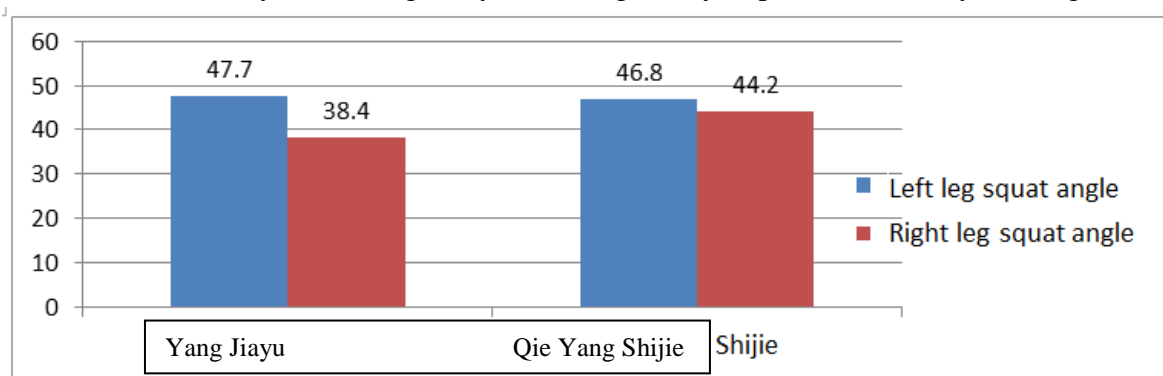


Fig.2 Rear Angle View

#### 3.3.2 Analysis of the Athlete's Thigh Overlap Knee Joint Angle.

The knee angle refers to the angle between the line connecting the center point of the ankle joint to the center point of the knee joint and the line connecting the center point of the knee joint to the center point of

the ankle joint. The knee angle is also an important indicator for the referee to sentence the athlete to foul. According to the definition of walking, the front leg should be stretched at least 42ms on the ground, and the naked eye can see the image of the front leg moving straight in the ground. This is the best forefoot landing time and space feature. It can be clearly seen from Fig.3 that Yang Jiayu's left thigh overlaps the knee joint at an angle of 103.2°, the right thigh overlaps the knee joint at an angle of 101.1°, and Qie Yang's left thigh overlaps at an angle of 98°, and the right thigh overlaps the knee joint. The angle of 94°, found through the literature, the angle of the knee joint overlap is more reasonable at 100°-110°, Yang Jiayu's thigh overlap angle is within a reasonable range, Qieyang Shijie is smaller than this range and significantly lower than Yang Jiayu's thigh overlap knee joint. The angle further illustrates that during the whole competition, Yang Jiayu's calf and hip are more relaxed, which is conducive to the development of technology. However, the angle of the knee joint of Qieyang Shijie is relatively small, which is easy to cause technical problems and needs further improvement.

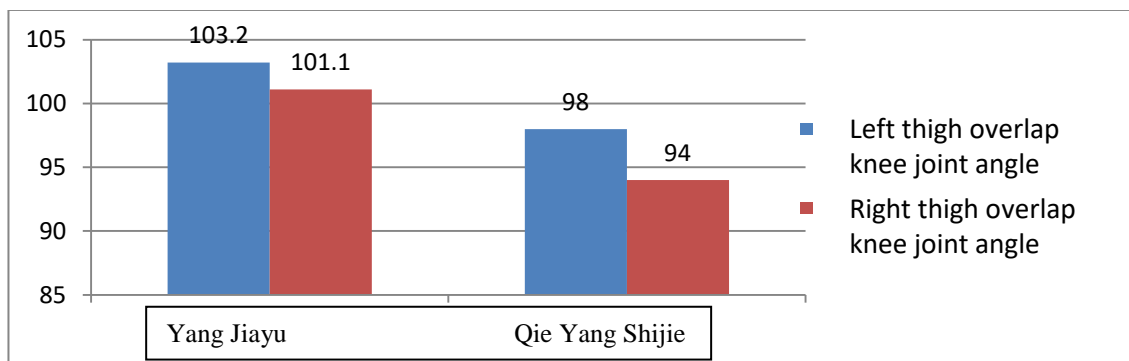


Fig.3 Thigh Overlap Knee Joint Angle

### 3.3.3 Analysis of the Angle between the Two Legs of the Athlete.

The angle between the two thighs refers to the angle formed by the big rotor and the toe of the swinging leg and the toe of the hind leg when the ground is about to leave the ground. It is obvious from Table 4 that the angle between the two legs of Yang Jiayu's left foot is 45.9°, the angle between the two legs of the right foot is 43.7°; the angle between the two legs of the left foot of Qieyang Shijie is 46.6°, and the angle between the two legs of the right foot is 50.3°, and the angle of the two leg clamps of Cordia Pugina is 48.1° and 48.3° respectively. By comparison, it is found that there are a big gap between the two athletes in China and the top international player, Cordia Pugina, and there are obvious differences in the angle between the left and right thighs. Especially Yang Jiayu is more obvious. Kodaya Pugina is 2.3°. The angle of the two thighs on the right is 4.6° smaller than that of Cordia Pukea. This shows that the two athletes are unbalanced during the race, in order to improve the future game. The number of thigh clips is recommended. It is recommended that athletes do more flexibility exercises to enhance the flexibility of the legs.

Table 4 Statistics on the Angle between the Two Thighs of the Athletes and the Angle of the Landing

Index Name	Angle angle between two thighs /°		Landing angle /°	
	Left	Right	Left	Right
Yang Jiayu	45.9	43.7	28.3	32.6
Qie Yang Shijie	46.6	50.3	26.6	26.0
Kodaya Pugina	48.1	48.3	28.3	28.7

### 3.3.4 Analysis of the Athlete's Landing Angle.

The angle of the ground refers to the angle between the sole of the foot and the ground during the movement, the heel strikes the ground. It can be concluded from Table 4 that Yang Jiayu's left foot landing angle is 28.3°, the right foot landing angle is 32.6°, the left foot is 4.3° smaller than the right foot, and the left landing angle is exactly the same as that of Cordia Pugina. The angle is 3.9° larger than that of Cordia Pugina; the angle of the left foot of Qieyang Shi is 26.6°, the angle of the right foot is 26°, and the left foot is 0.6° larger than the right foot. The difference between the degrees is basically Deyapkina is consistent, but the degree is slightly smaller than Cordia Pugina. The small angle of the ground is also one of the main technical problems of Shiyang Shijie [3].

### 3.3.5 Analysis of the Upper Limb Swing Angle of the Athlete.

The angle of the back swing of the boom refers to the angle formed by the vertical plane of the boom when the boom is swung back at the maximum angle, reflecting the range of motion. It can be seen from Table 5 that the angle of the back swing of the two athletes in China is obviously smaller than that of Cordia Pugina. The angle of the back swing of Qieyang Shijie is 8.9° smaller than that of Cordia Pugina, and the swinging motion is basically the same, but Yang Jiayu's rear swing movement is seriously inconsistent, and the left arm rear swing is 19° larger than the right arm rear swing. The technical style of the two athletes is small after the swing; and the outstanding athletes show a relatively stable back swing technique. The angle between the large and small arms is the angle between the large and small arms when the athlete swings forward during the movement, which reflects the amplitude of the swing and the level of relaxation. It can be seen from the table that Yang Jiayu has the smallest angle of the arm and arm clamps, and the angle of the left and right arms is 55.3°, which is 29.6° smaller than the angle of the Cordia Pugina, and the angle of the right and small arms is 52.8°. The angle of the angle is 39.8°, and the angle of the arm of the cut-off is several times. There are big gaps between the two athletes and the Kodiya Pujina, further indicating that Yang Jiayu's arms are too tight. Do not relax, causing tension in the upper limbs.

Table 5 Statistics on the Angle of the Upper Limb Swing of Athletes

Index Name	Rear swing angle /°		Angle of the arm /°	
	Left	Right	Left	Right
Yang Jiayu	61.9	42.9	55.3	40.2
Qie Yang Shijie	58.2	52.8	78.7	52.8
Kodaya Pugina	70.8	74.8	84.9	80

### 3.4 In Summary

The technical characteristics of Yang Jiayu's performance are “small step high frequency”. There is a difference in the balance between the two steps of the cut-off of the two sisters; the two athletes have a big gap between the two legs, and the left and right footsteps are unstable. In particular, Yang Jiayu is more obvious, reflecting the lack of flexibility of the hip joint, causing fluctuations in the center of gravity of the body.

The center of gravity of the two athletes in China is fluctuating. Yang Jiayu's thigh overlap angle is within a reasonable range. It shows that during the whole game, Yang Jiayu's calf is relaxed, which is conducive to the development of technology, while Qie Yang's thigh overlaps the knee joint. The angle is relatively small, which is easy to cause technical problems and needs to be further improved.

Yang Jiayu's landing angle is slightly smaller; the difference in the angle of the land of Qie Yang Shi is basically stable, but the angle is too small. The upper limb angles of the two athletes in China are small, showing that the back swing is small, and Yang Jiayu's arms are too tight and not relaxed, resulting in tension in the upper limbs.

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