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Characterization of the competitive strength of men's artistic gymnastics in China

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Abstract

Introduction and purpose : The 2022 National Gymnastics Championships men's artistic gymnastics competition was examined and analyzed in order to assess the competitive strength of China's men's artistic gymnastics under the new regulations. The analysis included a review of China's men's artistic gymnastics problems and current performance status, as well as suggestions for strengthening the sport.

Materials and methods: Using the literature method—searching and analyzing through the CNKI, WOS, library, and other databases—as well as the observation method and mathematical and statistical techniques for statistical analysis of the athletes competing in the various regions and units, as well as field research and study methods involving video and on-site game observation—first-hand information was obtained for this paper's theoretical support.

Conclusions: men's artistic gymnastics in China is not developing regionally, with strong regions in the south

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and weak regions in the north, as well as strong and weak regions in the east and west;These disparities in the sport's development also affect athletes' overall competitive strength, with athletes in various sports having wide disparities in their scores and failing to create a supportive environment for competition, particularly in individual all-around, pommel horse, rings, and horizontal bars projects; Additionally, China's men's artistic gymnastics athletes' age structure needs to be further optimized. It is necessary to continue executing the preparatory plan of mending the short boards and strengthening the strong items.

Keywords: men, artistic gymnastics,competitive strength, characteristics

Introduction

Artistic gymnastics is a fundamental component of China's Olympic Striving Program plan, as well as the most advantageous program within China's competitive sports sector [1]. At various phases and for varying lengths of time, men's artistic gymnastics is the cornerstone of China's gymnastics campaign to break into the world's gymnastics powerhouse [2]. Countries competed more ferociously in men's artistic gymnastics development medal diversity, rule variability, and technical movement complexity. men's artistic gymnastics in China has a volatile history of winning gold and silver in international competitions, particularly after the disastrous 2004 Athens Olympics and their lackluster performance in Rio in 2016. The dilemma of “high level and low popularity”is concealed by the growth of men's artistic gymnastics in China [3]. China's artistic gymnastics talent pyramid is at risk of collapsing due to overstretching of reserve talent, inactivity among coaches, and insufficiency among athletes. Additionally, the country's artistic gymnastics regional development is unbalanced, with strong provinces not weak and weak provinces not strong. School gymnastics is dying off and not developing as fast as it could. Men still excel in artistic gymnastics, whereas women do not. The development of the six separate events is not synchronized, with the strong events becoming even weaker and the all-around athletes lacking the ability to excel in a particular event. Nations involved in the Paris Olympic cycle are vying with each other to be the competitors. In addition to serving as a practice and selection match for participation in the 51st World Gymnastics Championships in Liverpool, England in 2022, the National Gymnastics Championships are a national artistic gymnastics event of the highest grade, level, and specification. They also serve as an acclimatization and challenge match for the 2022 Asian Games in Hangzhou, China. In accordance with the new cycle's regulations, the 2022 National Gymnastics Championships will serve as the focus of inquiry and study to assess the state of China's men's artistic gymnastics, examine the elements that make up the sport's

competitive strength, establish the framework for the sport's long-term growth, and generate concepts and theoretical references for the country's artistic gymnastics development plan for the Paris Olympics.

1. Research results

1.1. Distribution characteristics of participating regions and number of athletes

The 2022 National Gymnastics Championships men's artistic gymnastics Competition had a t otal of 128 athletes from 21 regions of the country, compared with 163 athletes from 21 regio ns who participated in the 2021 All-Championships, the number of participating provinces an d cities was the same but the total number of participants decreased by 35 athletes. From Figu re 1, it can be found that the men's competitive gymnasts in this year's Full Championships ca me from seven regions: Northeast, North, Central, South, East, Northwest and Southwest Chi na. Among them, there are 48 athletes from East China, all seven provinces have people partic ipating in the competition, which has the largest number of athletes; followed by South China with 25 participants, it is worth mentioning that there are 17 athletes participating in Guangdo ng Province; then there are 23 athletes from three provinces in Southwest China, which is a re latively average number of participants from the three provinces; and the worst ones are three from Northwest China and one from Northeast China. Analyzing from the participating region s, East China has a wide mass base, with a large number of participants and a wider range of p articipation. On the contrary, in Northeast and Northwest China, the economy is backward, th e degree of importance is low, and the number of participants is small. From the participating provinces reflecting Guangdong, Jiangsu, Zhejiang, Shandong, Sichuan to see the exhibition i s highly valued, the number of participants, the scope is wider. Overall, 2022 National Gymna stics Championships men's artistic gymnastics program participating athletes belong to the reg ion is mainly concentrated in South China, Central China, East China and Southwest China, e specially Hunan, Guangdong, Guangxi, Zhejiang, Jiangsu, Shandong, Sichuan provinces have more than 8 athletes to participate in the show, with a strong competitive strength and person nel distribution, for the fight for the top eight, to obtain the medals and even the gold medals t o provide the fighting force.

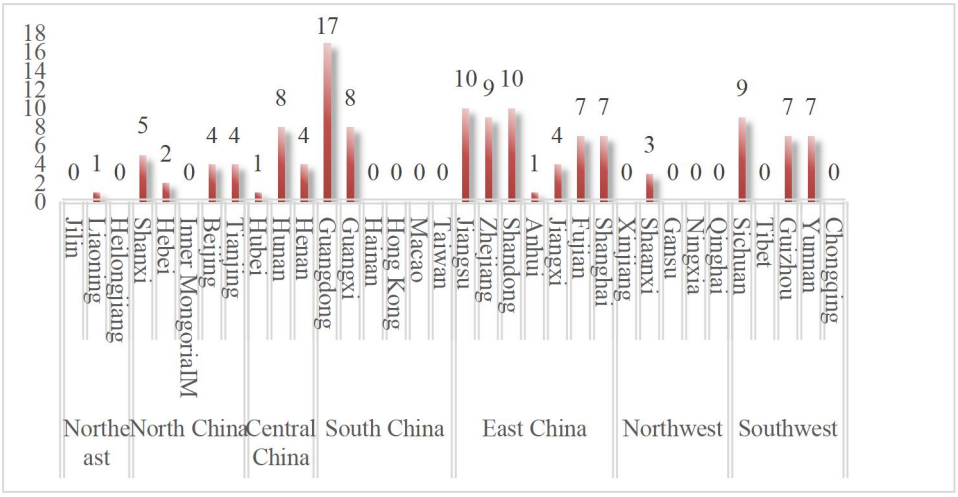

Figure1. Distribution of regions and numbers of men's artistic gymnastics participants in the 2022 National Gymnastics Championships
Source: Own study

1.2. Age distribution characteristics of men's artistic gymnastics participating athletes

men's artistic gymnastics Championships in 2022: 72 athletes from the top 24 in the all-around and the top 8 in the individual event were registered, sorted, and screened. A total of 51 athletes competed for men's all-around and individual event medals. This was determined by analyzing the ages of the athletes who won the all-around and individual event finals. Four new force representatives from Shanghai, Yunnan, and Jiangsu were born in 2005, just in time to compete in the junior division at the age of 17. The oldest is Jiangsu veteran world champion Youhao, who turned 30 this year. Born in 1992, Youhao has flourished in the national high level stage despite an age difference of three Olympic cycles and a 13-year age span.This is because only Youhao, a gymnast who is 30 years old, is 29 years old; most athletes range in age from 17 to 28 years old.
Overall characteristics of the age distribution show that most athletes are focused in the 17–24 age range; 43 individuals made up 84.3% of the research athletes. Only those 24 years old had the highest number of participants, reaching nine. The number of participants steadily climbed from 17 to 21 years old, then steadily declined and then steadied from 22 to 30 years old. According to data, the 51 competing athletes' average age was 21.63 years old. This figure reflects how the athletes responded to age differences, passed on knowledge to one another, drove together, and competed on the same stage.
China's best men's competitive gymnasts are becoming older, which is important for their preparation for the Olympics in Paris. Younger athletes don't have as much competition experience, while older competitors run the risk of being injured or not being physically

strong enough to have a better chance of medaling. The average age of males competing in gymnastics was determined to be 24.9 years old, 24.95 years old, 25.27 years old, and 25.80 years old in the four Olympic Games from the 29th to the 32nd [4]. From the average age of 21.63 for All-Championships outstanding male athletes to 23.63 for the 2024 Paris Olympic Games cycle, our nation has a better reserve of reserve talent age structure reserves for China's men's artistic gymnastics in the Paris Olympic Games preparation to lay a solid foundation. This is in contrast to the average age of participation in the Olympic Games. In particular, the majority of athletes, including the key members of our national team, Sichuan Zou Jingyuan and Hunan Yang Jiaxing, are 24 years old. These athletes must adhere to the average age of participation law, meet the requirements of the age structure in order to participate fully, and meet the Olympic Games' golden age of medal law, which is based on the age structure of the gold and silver competition.

1.3. Age distribution characteristics of medal-winning athletes in each event of men's artistic gymnastics

In the men's artistic gymnastics events at the 2022 National Gymnastics Championships, a total of 14 athletes took home 21 medals (see Fig 2). The age nodes with the highest number of medals are 21, 22, and 24 years old, and three individuals, or nine athletes total, won medals in each age group. For China's men's artistic gymnastics team to win medals, the age group of 21–24 years old is crucial, and it accounts for 71.4% of the total. World champions Sun Wei and Youhao, who are respectively 27 and 30 years old, are still quite competitive. China's men's artistic gymnastics team depends a lot on its medal-winning male athletes being in the age range of 21 to 24. This age group accounts for 71.4% of the total medal count. Sun Wei and Youhao, the two world champions, are 27 and 30 years old, respectively, and they both remain fierce competitors. Youhao won the parallel bar double championship and the rings, while Sun Wei took home the silver medals for individual all-around and single bar. Chen Zhiyi of Guangdong, the youngest medallist, took home the bronze in the vault, while Ye Diqing, an exceptional athlete from Yunnan, took home the bronze in the rings. Both the more seasoned athletes and the less experienced athletes had the opportunity to fight for medals in the same tournament, but they were at a disadvantage because of many factors such as injuries, experience, physical fitness, and psychological issues. The athletes' age ranges ranged from 11 years old to 11 years old, which indicates that the age structure distribution of China's medal-winning athletes is not balanced and the age ladder distribution is not scientific. Given the embarrassment of having too few young athletes, it is still urgently necessary to

figure out how to best age structure the country's exceptional men's gymnastics team in order to demonstrate sustained competitiveness.

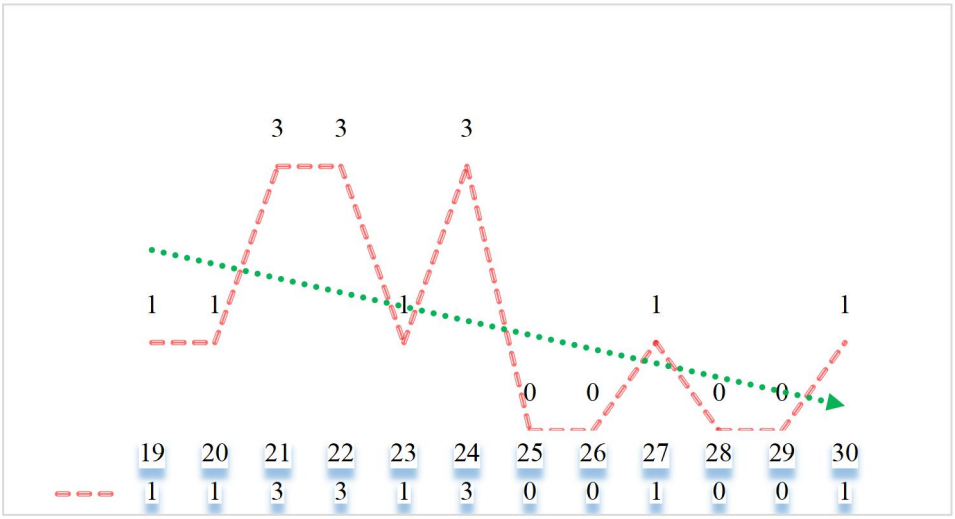

Fig2. Age distribution characteristics of medal-winning athletes in men's artistic gymnastics at the 2022 National Gymnastics Championships
Source: Own study

2. Men's artistic gymnastics competitive strength Analysis

2.1. Analysis of overall competitive strength pattern

The competition rules for the 2022 National Gymnastics Championships state that men's artistic gymnastics will feature 42 medals overall across 14 individual, team, and individual team events. Eight provinces and cities—Jiangsu, Hunan, Guangxi, Zhejiang, Guangdong, Shandong, Sichuan, Yunnan—were selected from the medal-winning provinces and cities for analysis. These provinces and cities are primarily located in central, east, and south China, particularly in Hunan and east China. Jiangsu remarkably won 25 of the 42 medals, or 59.5% of the total. According to the analysis of the winning medal list (see table 1), Hunan placed first with a total of 13 medals—5 gold, 5 silver, and 3 bronze. Hunan Zhang Boheng, the gymnastics team from China, is happy that individual all-around won five medals in the solo program alone (three gold and two bronze). Jiangsu (12 medals) is the runner-up in the medal table with 6 gold, 4 silver, and 2 bronze. The overall view of the relative concentration of gold medals, mainly Jiangsu and Hunan, shows a strong dominance in the domestic and dominant position, demonstrating the strong competitive strength of the domestic sport. Jiangsu leads the gold medal list analysis with six gold medals, followed by Hunan with five, Guangxi with two, and Zhejiang with one. The Zhejiang squad won seven medals as the host—two gold, two silver, and four bronze. Furthermore, the team's accomplishment demonstrated a certain competitive strength and a bright future when rising

star Yang Haonan withdrew from the competition due to injury. The teams from Jiangsu and Hunan, respectively, won eleven medals in the project, demonstrating their strength. In contrast, other cities and provinces must work to strengthen their competitiveness in order to catch up with the development of artistic gymnastics. The nation must also quickly adjust and maximize the competitive strength of the gaps between its various provinces in order to foster mutual formation, competition, and catching up with one another.

Table 1. Men's Competitive Gymnastics Medal Statistics by Province and City

Rank	Province	Gold	Silver	Bronze	Total
1	Hunan	5	5	3	13
2	Jiangsu	6	4	2	12
3	Zhejiang	1	2	4	7
4	Guangdong	0	0	3	3
4	Shandong	0	2	1	3
6	Guangxi	2	0	0	2
7	Sichun	0	1	0	1
7	Yunnan	0	0	1	1

Source: Own study

2.2. Men's all-around competitive strength analysis

According to the rules of the Championships qualifying and final total for the athletes all-around score for the final score, from Hunan athletes Zhang Boheng qualifying 6 zero error strength play excellent, stable first place, higher than the second place Zhejiang junior Yang Haonan 2.55 points. In the first five item final, Boheng continued to perform bravely, taking first place in the first three of the five items, ranking first in the final. In the final horizontal bar, there was a small error, but still no suspense to win the all-around title. he undoubtedly took home the all-around crown, though. Yang Haonan, a rising star in Zhejiang, placed second in the qualifying round. Her performance excited many, but sadly, the horizontal bar program only received 6.90 points in the final round due to technical instability, inexperience, and a pommel horse error that caused the bar to fall off the equipment. The horizontal bar also suffered an injury during the final bar failure and was forced to retire. Jiangsu's legendary world champion Sun Wei, a brilliant general with a strong will and courage, overcame an ankle ailment to complete a bar program that tested her resolve and resulted in a rebirth into nirvana. he also won the second all-around title. Yang Jiaxing, a Hunan athlete who took home the bronze medal, demonstrated outstanding technical proficiency and mental toughness by playing with 12 sets of motions and zero errors.

2.3. Analysis of men's team competitive strength

The number of participants in the team event has gradually decreased as a result of FIG's

constant modifications to the team competition system at the recent Olympic Games. These modifications include the adoption of the 5-3-3 competition system in 2012 and 2016, the 6-3-3 competition system in 2004 and 2008, the 6-5-4 competition system in 2000, and the 7-6-5 competition system prior to 1997 [5].2020 Tokyo Olympics in Tokyo. Gymnastics competition uses the "4 + 2" format, meaning that four athletes compete as a team and an additional individual earns two points for placing in both the single event and the all-around. men's artistic gymnastics team competition qualifying 4-4-3, the ultimate 4-3-3 system, requires multiple strong athletes, ideally all-arounders with exceptional athletic performance, in addition to one exceptional athlete. The International Gymnastics Federation (FIG) modified the competition format upon entering the Paris Olympic cycle. The 2012 London Olympics and the 2016 Rio Olympics both used the team qualification "543" and final "533" system, which will be used at the Paris Olympics. The National Championships will employ the same 6-5-4 format as the 2000 Sydney Olympics in an effort to develop more exceptional athletes and preserve China's multi-talented and all-around athletes.
The one thing that has remained constant throughout the system of competition changes is that each person has exceptional athletes; team competition is still developing toward all-around athletes; and there is an increased focus on the success rate of athletes, as well as artistic and ornamental aspects. Although there are all-around champions and free gymnastic champions Zhang Boheng, the lone palm is difficult to beat, the double fist is difficult to beat the four hands, and just one lost to Jiangsu 2.45 points. Hunan also needs to improve the difficulty and quality of the action. Based on the analysis of the team competition results, the Jiangsu and Hunan teams' results are significantly ahead of the top two results that are indistinguishable from each other. Jiangsu team received three first, two second, and two third in six individual items. Overall strength analysis shows that Hunan and Jiangsu have always had strong competitive strengths, and rising Zhejiang is gradually becoming more and more capable of posing a threat to other provinces. However, in order to move up the ranks and become a serious contender for the gold medal, Zhejiang must continue to improve the action's difficulty and refinement.

2.4. Men's Individual competitive strength Analysis

2.4.1. Analysis of men's floor exercise competitive strength

Based on the men's floor exercise final results (see table 2), the quality of movement completion is primarily responsible for the medal chances, with difficulty score differences not being statistically significant. The top three athletes' average difficulty score was 6.033, while Zhang Boheng, the Hunan athlete who won, had the highest difficulty score of 6.1.

Zhang Boheng, an athlete from Hunan and the winner of the first position, placed third out of eight competitors in the qualification stage despite only scoring 5.8 points in difficulty. Zhang Boheng's flawless finish allowed him to place first in the qualification round. Zhang Boheng, the defending champion, also increased the difficulty in the final. The second string of the back 900 front straight was changed to the back 900 front two weeks, which is a very popular and difficult turnover connecting movement under the new rules and it can get 0.2 extra point for the connection. The difficulty was increased to 6.1 points, and he won the gold medal thanks to the high quality completion score of 8.533 points. This is because the new rules do not award extra points for direct connections of the one-week flip with an extra degree. Gold Medal. The second and third-placed Shandong athletes are a formidable team in the floor exercise program. Their performance is excellent in both difficulty and completion; the entire set of movements is choreographed with a smooth and coherent personality; numerous challenging skills are executed flawlessly; and with a champion's total score of only 0.033 points, they rightfully win the silver and bronze medals. Overall, floor exercise is becoming more stable and allows athletes to perform to the best of their abilities. However, there is still a gap in the difficulty of floor exercise finals and international competitions, so it is unrealistic to rely solely on excellent performance to win a medal or even gold. The international arena medal competition is becoming more multinational and unpredictable, and no country has been able to consistently win medals. This also presents us with a good chance to compete on the international scene. Additionally, this gives our nation a strong chance to compete internationally and bring home medals. As a result, medal-winning competitors should possess both a high degree of completeness and a world-class difficulty level in their motions.

Table 2. Men's artistic gymnastics floor exercise event final results statistics
Source:Own study

Rank	Name	Pronvice	Difficulty Score	Penalty	Execution Score	Score
1	Zhang Boheng	Hunan	6.1		8.533	14.633
2	Su Weide	Shandong	6.0		8.600	14.600
3	Ge Shihao	Shandong	6.0		8.566	14.566
4	Yang Tianle	Jiangsu	5.6		8.500	14.100
5	Tangqi	Jiangsu	5.6		7.933	13.533
6	Chenfeng	Hubei	5.6	0.3	7.933	13.233
7	Zhang Yangyu	Guangdong	5.4	0.4	8.200	13.200
8	Chen Zhilong	Guizhou	5.7		7.166	12.866

2.4.2.Analysis of men's pommel horse competitive power

Regardless of the event's level or previous individual all-around, the men's pommel horse program has the highest error rate and the most people falling from the apparatus out of the six individual all-around (see Table 3).Lu Chongcan, a Guangxi athlete, finished second in the qualifying round with a difficulty score of 5.8 points. In the final round, the difficulty score was increased by 0.4 points to 6.2 points. The individuality and smoothness of the movement sets were choreographed, and the overall field scored 8.566 points of high quality to win the program's gold medal.Tianhao, the Zhejiang athlete rated second, employed the same degree of difficulty in both the qualification and the final, earned a comparable completion score, played and performed steadily, and took second place. Zhang Boheng, who started third, was the last to go and resisted pressure to increase the difficulty from the qualifying round by 0.3 points. However, he regretted winning the bronze medal since he made a mistake during the race and did not receive a good finishing score.

Unfortunately, the dropped apparatus in the game remains the most difficult task over the entire Jiangsu veteran world champion Olympic third place field. Sun Wei played poorly, finishing with just 7.466 points to secure fourth place. Athletes who placed in the top three with an average difficulty score of 6.033 points and a completion score of more than 8 points won the title in the clearly defined law. This was necessary to achieve exceptional results that were not only higher than the opponent's difficulty but also of a high caliber. Conversely, other athletes have all of their mistakes fall off the equipment, and they lose no good completion score along with the medal. In the pommel horse program, the key to winning a medal is to outperform your opponent in terms of difficulty, complete well, and—above all—have a stable play without falling off the equipment.

Table 3. men's artistic gymnastics pommel horse event final results statistics

Rank	Name	Pronvice	Difficulty Score	Penalty	Execution Score	Score
1	Lu Chongcan	Guangxi	6.2		8.566	14.766
2	Tianhao	Zhejiang	5.9		8.266	14.166
3	Zhang Boheng	Hunan	6.0		8.033	14.033
4	Sunwei	Jiangsu	6.4		7.466	13.866
5	Wu Xiaoming	Guangdong	5.7		7.500	13.200
6	Xiao Ruoteng	Beijing	5.9		7.300	13.200
7	Yang Tianle	Jiangsu	5.6		7.566	13.166
8	Yang Jiaxing	Hunan	5.2		7.466	12.666

Source:Own study

2.4.3.Analysis of men's rings competitive strength

China's Olympic rings project won first and second place in the Tokyo Olympics, showcasing its world-class difficulty. Liu Yang, who was injured and could not compete, won the championship, but Youhao, a Jiangsu veteran, took second place with remarkable strength and athletic ability. Youhao was the last competitor on the field, and both the qualifying round and the finals had the same 6.7 difficulty, along with a high-quality finish, a stable landing, and a stable position as the champion.

Table 4. Men's artistic gymnastics rings event final results statistics

Rank	Name	Pronvice	Difficulty Score	Penalty	Execution Score	Score
1	Youhao	Jiangsu	6.7		8.600	15.300
2	Zou Jingyuan	Sichuan	6.2		8.800	15.000
3	Ye Diqing	Yunnan	6.2		8.033	14.233
4	Yu Zhihui	Guangdong	5.7		8.266	13.966
5	Meng Zhiwei	Guangxi	6.0		7.866	13.866
6	Zhang Boheng	Hunan	5.8		8.000	13.800
7	Lan Xingyu	Guangxi	6.3		7.433	13.733
8	Liu Hengyu	Shanxi	6.1		6.166	12.266

Source:Own study

With an exceptionally high quality 8.8 finish score, Zou Jingyuan, the strongest parallel bar Olympic champion from Sichuan, placed in second place. Guangxi Lan Xingyu, who has a difficulty of 6.3, finishes well as well. In the qualification round, he achieved the same level of difficulty, earning 8.550 execution score; sadly, due to method errors, he only managed to receive 7.433 points in the final, missing out on the medal. Ye Diqing of Yunnan, who had a difficulty of 6.2 as well, finished with a considerable difference in quality but made no major errors to finish in third place.The world's top individual athletes, Liu Yang and Youhao, lead the world and China's development of the rings project, more optimistically, showing a huge advantage in the rings this project. Of the previous 8 athletes, Youhao alone in a class, with world-class difficulty; in the completion of the quality, Zou Jingyuan and Youhao more high quality. However, the reserve force is weak, and there is a chance that there won't be enough youth or that a generation will be broken. As a result, young athletes should be trained more to increase the difficulty and improve the quality of China's hoops project completion in the international arena so that the nation can continue to compete for gold and silver.

2.4.4. Analysis of men's vault competitive strength

The vault program's regulations were drastically changed for the 2022–2024 Paris cycle, going from five groups to four groups. This increased demand will push competitors' entire

skill set. Athletes must do two jumps in separate groups throughout the vaulting event's qualification and final, which calls for exceptional explosive power, skill application, and psychological adaptability. Chen Yilu, a 24-year-old veteran from Zhejiang who vaulted to win the silver medal at the 14th National Games, deserved to win the gold medal in qualifying and preliminary rounds after demonstrating extremely stable performance in qualifying and the finals of this National Championship. The quality of completion also won both the judges and audience, who both awarded a high score of 9 points, meaning that it possesses the strength to fight for medals on the international stage. The average difficulty level was 5.7 points. Shanghai's second qualification is to let the national eye Wu Jianhao achieved the highest single jump score of 15.350 points (6.0 + 9.350) after leaping out of the world's hardest 6.0 Li Siguang jump. Sadly, he made a major mistake in the final and ended up on the mat on his knees for eighth place.

Table 5. men's artistic gymnastics vault event final results statistics

Rank	Name	Pronvice	Vault	Difficulty Score	Execution Score	Penalty	Vault Score	Total
1	Chen Yilu	Zhejiang	1	5.6	9.333		14.933	14.999
			2	5.8	9.266		15.066	
2	Liuyang	Hunan	1	5.6	9.200		14.800	14.333
			2	5.0	8.966	0.1	13.866	
3	Chen Zhiyi	Guangdong	1	5.2	8.833	0.1	13.933	14.166
			2	5.2	9.200		14.400	
4	Tao Haopeng	Henan	1	5.2	9.200		14.400	14.116
			2	4.8	9.033		13.833	
5	Wang Hailu	Hebei	1	5.6	9.200		14.800	14.033
			2	5.2	8.066		13.266	
6	Hu Youtian	Jiangsu	1	5.6	9.300		14.900	13.966
			2	5.2	7.833		13.033	
7	He Quqin	Guangdong	1	5.6	7.833	0.3	13.133	13.916
			2	5.6	9.100		14.700	
8	Wu Jianhao	Shanghai	1	6.0	7.866	0.3	13.566	13.849
			2	5.2	8.933		14.133	

Source:Own study

The first-ranked jumper's average difficulty was 5.7 points, according to an analysis of the competition results (see Table5). The average difficulties of Chen Zhiyi of Guangdong and Liu Yang of Hunan were 5.3 and 5.2 points, respectively. The vaulting program in the domestic difficulty is the same case to see which athlete to complete the quality of the good, high in the air, landing steadily will get a higher quality points. Athletes ranked 5-8 in the average difficulty score of 5.5 points, while those ranked fourth in the field have the lowest difficulty score of only 5.0 points.

The Olympic Games aim for great results in vaulting two leaps, with action difficulty of more

than 5.6, and difficulty serving as the material basis for winning the vaulting competition [6]. Only the full championships are eligible for this. It was once believed that Li Xiaopeng's vaulting action of the “Li Xiaopeng jump”would lead to the rise of the Chinese gymnastics team vaulting program both domestically and internationally. However, it was anticipated that Li Xiaopeng's vaulting action would be the pinnacle of China's vaulting action. China's cultivation of the world's top-notch top vaulting athletes with high degree of difficulty athletes to reappear in the glorious moments can be described as a long way to go.

2.4.5. Analysis of the competitive strength of men's parallel bar

No matter how difficult the action is or how well it is completed, China is one of the strongest nations when it comes to parallel bar gymnastics. Our athletes Zou Jingyuan and Youhao both won gold medals in the recently concluded Tokyo Olympics with 6.9 difficulty points and 9.333 execution score, respectively. Youhao also placed fourth with 8.566 execution score.Due to an unintentional error in the qualifying round, Sichuan Zou Jingyuan was unable to go to the final. With the same level of difficulty as his ultra-stable and excellent play, Jiangsu Youhao prevailed in both the qualifying round and the final, surpassing everyone with his flawless athletic performance. Hu Xuwei, a competitor for the Chinese national team and the 2021 World Gymnastics Championships winner in the bars and double bars, finished the competition with a subpar performance, a weak finish, and a lack of consistency, which prevented her from taking home a medal. Hunan Zhang Boheng, the third-place winner, needs to keep up the good work by making the moves harder, perfecting each one, and continuing the Chinese gymnastics team's beneficial programs if he is to become the team's staple.

2.4.6. Analysis of men's horizontal bar competitive strength

Zhang Boheng, a Hunan athlete, emerged last, overcame the psychological effects of his all-around mistake, fought against pressure, played steadily, landed steadily, and heard thunderous applause as he won the bar championship with the second-highest difficulty and the highest completion score overall. Sun Wei, a Jiangsu athlete who finished second in the all-around and bar final, was recognized by the judges and audience for her seasoned tenacity of will and her high and stable play at the hardest level. Tianhao, a Zhejiang athlete substitute, did well and took home the bronze. Our athletes' overall difficulty is not very high, the connection bonus points are not used as often, and the current difficulty score is not strong enough to contend for Olympic gold, according to an analysis of the difficulty (see Table 6). From the standpoint of the completion score, it is evident that space is progressing slowly; in

particular, the Zhang Boheng champion has a fairly high completion score, but he may not reach the ranks of the medals in the international arena. Overall, the new regulations present a greater challenge to our athletes in competitive arena performance; currently, our nation's bar program lacks action choreography with medal competition; therefore, the action must be made more difficult. The new regulations also aim to stabilize the lower law, improve the connection score, and enhance the quality of the new ascending group's action completion.

Table 6. men's artistic gymnastics horizontal bar event final results statistics

Rank	Name	Pronvice	Difficulty Score	Penalty	Execution Score	Score
1	Zhang Boheng	Hanan	6.2		8.733	14.933
2	Sunwei	Jiangsu	6.4		8.200	14.600
3	Tianhao	Zhejiang	6.0		8.366	14.366
4	Zhang Songhonghao	Henan	5.7		8.533	14.233
5	Jitian	Guangdong	5.6		8.366	13.966
6	Liao Jialei	Hunan	6.1		7.666	13.766
7	Wei Guozheng	Shandong	5.1		8.500	13.600
8	Youhao	Jiangsu	5.1		7.066	12.166

Source:Own study

3. Discussion

3.1. Regional development problems

There is a significant regional development imbalance, no remedies, and little chance for improvement. The majority of competitors are from North China, South China, Central China, East China, and Southwest China; only four athletes represent Northwest and Northeast China. Hubei accounts for 7.7% of Central China's participants, Anhui for 2% of East China's, and even worse, Hainan and Chongqing have no artistic gymnastics programs. Provincial and municipal development is unequal and disorganized in each region. The competitive power of the provinces and municipalities varies greatly; at the moment, Jiangsu, Hunan, Guangdong, and Guangxi are the primary gymnastics provinces and municipalities in China. Shandong, Guizhou, Zhejiang, Fujian, and Sichuan make up the majority of the second tier. The provinces and cities that presently insist on implementing Jiangxi, Shanxi, Beijing, Tianjin, Shanghai, Hubei, Anhui, Shaanxi, and Henan make up the third echelon. The untapped regions for the growth of artistic gymnastics are Jilin, Heilongjiang, Xinjiang, Tibet, Ningxia, Gansu, Qinghai, Chongqing, Inner Mongolia, Hainan, and other provinces.

3.2.The competitive strength gap between athletes in each program is obvious problem

collective outcomes Hunan and Jiangsu One point separates the two teams' strengths, but the

Zhejiang club in third place is eight points ahead of the second, clearly indicating a competitive level differential. Zhang Boheng's individual all-around athletic prowess is nearly four points stronger than that of the second-place Jiangsu veteran Sun Wei; the difference between the competition results for runners-up and third place is not evident, and their strengths are equal; however, third place is 3.65 points stronger than fourth place, and neither place has a medal. The difference in a single medal score for floor exercise is not very noticeable, even with equal strength. However, the difference in medalists' scores between 4–8 athletes is more noticeable, with an average difficulty score difference of 0.45 points. These athletes are ranked lower than their competitors not only in terms of difficulty but also in terms of finish score. The pommel horse single event has the highest error rate, but even though the top three athletes did not make any mistakes, there is still a clear achievement gap. Lu Chongcan's finish score is 8.566 points higher than the high score of second place, which is 0.6, and the other athletes' names are more noticeable due to their differences in competition results. The group's leader was the rings single event world champion Youhao. The athletes in second and third place rely on the higher completion of the score of the first and third runner-ups; however, the gap between the players is different, revealing the instability of the poor, the difficulty of the low, and the unstable landing station. Chen Yilu leads the three athletes (Gao Jianhao, He Xiuqin, and Chen Yilu) by virtue of the height of the degree of D points and better quality of the championship completion. The parallel bar project is considered China's most beneficial project. Because of Sichuan Zou Jingyuan's surprise withdrawal, veteran Youhao proved to be unstoppable and won the highest finish and difficulty score, leaving the other athletes' finish score and difficulty score disparity unclear. Zhang Boheng, the winner of the individual event, depended on landing hard and having a better complete score to take first place. The first two competitors had similar strength, and it was difficult to see how much the subsequent competitors differed from them.

3.3. Problem of reserve talents of gymnastics

There is a severe shortage of reserve troops since the number of people in China who train in gymnastics has been steadily falling in recent years and because many elementary and secondary schools do not even provide gymnastics programs. Less than 7,000 persons nationwide, spread over more than 30 provinces and cities, are currently enrolled in gymnastics training programs—less than half of the provinces that are typically able to offer both amateur and professional gymnastics training [7]. The issue of inadequate reserves in Chinese gymnastics was discussed with Ye Zhennan, deputy director of the State General

Administration of Sport's Gymnastics Management Center. Ye advocated many years ago for gymnastics to be taught in elementary and secondary schools, but not much has changed in that regard. The national team must train for both the Universiade and the World Championships simultaneously, especially in years when competition is very intense. Because of a shortage of reserves, they may only use second and third-tier players—not the best of the best—when they have no one else available. While there are athletes to compete, certain provinces and cities have less participants than those who are ineligible. The majority of Chinese gymnasts currently rely on government funding for their four-level pyramid training, as well as training from local sports schools and sports schools. A significant portion of primary and secondary schools essentially do not offer gymnastics instruction, and athletes who retire after significantly losing talent do so through narrow upward channels.

3.4. Strengths and weaknesses of the program issues

The world's most difficult and well-executed parallel bar and rings program in China is still going strong. The athletes' competitive strength gaps are less pronounced, and the program's overall competitive strength is more balanced than other programs. However, other projects lack the breakthrough momentum in the all-around area. Regression is evident, and the impact of filling in short boards and closely monitoring weak items is not immediately apparent.

4. Conclusion

The artistic gymnastics development gap area persists in China, where the east and west are strong and the south is weak, and the country's regional development in men's artistic gymnastics is not balanced;Our athletes' overall competitive power is unbalanced; there is a significant score disparity among athletes in different sports, and the competitive atmosphere has not been established well, particularly in the individual all-around, floor exercise, pommel horse, rings, and bars programs; China's men's competition gymnastics need to better implement the preparation approach of stronger in the strongest events, make up for the shortcomings and further optimize the age structure of their gymnasts.

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