Comparative study on outstanding modern pentathlon athletes selecting in China

Zhou Yuan[1, a], Chloé Moreau[2, b, *],

[1]Zhejiang University, No. 866, Yuhangtang Road, Xihu District, Hangzhou, Zhejiang, 310058, China
[2]Cornell University,300 Day Hall, Ithaca, New York,14853, USA
a.xiaoyuan_0831z@qq.com, b.moreau8564_Chloe@163.com
***Corresponding Author**

Abstract: This study compares and analyzes the performance of athletes from various sports backgrounds after they transition to modern pentathlon. The results indicate that male modern pentathletes with a swimming background significantly outperform those with a running background in all performance indicators. For female modern pentathletes, there is no significant difference in performance between those with a swimming and running background. It is recommended to comprehensively adjust the talent selection direction, fully implement the strategy of selecting outstanding modern pentathletes from high-level swimmers, and cease the selection of modern pentathletes from athletes in sports other than swimming. Additionally, the talent selection strategy for female modern pentathletes should be adjusted, taking the excellent male modern pentathletes in China as a reference, to increase the selection of outstanding female modern pentathletes from high-level swimmers.

Keywords: Modern Pentathlon, Athlete Selection, Swimming

1. Introduction

Modern pentathlon is composed of five events: shooting, fencing, swimming, equestrian, and running. After the 2008 Olympics, new regulations were introduced to enhance the spectator appeal of the modern pentathlon, adjusting the previous competition sequence to fencing, swimming, equestrian, and combined running and shooting. At the 2005 World Championships, our country's outstanding modern pentathlete Qian Zhenhua won the championship, becoming the first Asian athlete to win the modern pentathlon world championship. Following that, at the 2012 London Olympics, Cao Zhong Rong won the silver medal in the men's individual event, achieving a historic breakthrough for China in this event at the Olympic level, marking the first time China won a medal in the modern pentathlon. As a result, the event has increasingly garnered attention.

China's modern pentathlon development started relatively late, and the overall level is comparatively low. The selection of athletes has only begun to take shape after continuous practice, and it is not uniform. A method of mainly selecting outstanding modern pentathletes from swimmers has been formed, but at the same time, some provincial and municipal teams still select from runners, and even focus on athletes who are skill-oriented, such as selecting modern pentathletes from shooters and fencers. This has led to a lot of futile efforts, affecting the development of the sport and causing China's average level to lag behind. Scientific talent selection can achieve twice the result with half the effort, and narrow the gap between China and the world level. Therefore, by comparing and analyzing the performance of athletes from various sports in recent years, some patterns have been identified, which provide a certain theoretical reference for China's modern pentathlon talent selection. Integrating advantageous resources and concentrating strengths are of great significance for the rapid development of China in this sport.

As is well known, the strength of a project's reserve force plays a crucial role in its long-term development. Errors in talent selection can lead to the waste of a large amount of manpower, material resources, and financial resources, which can affect the development of the project to a certain extent. In this study, the scientific nature of the athlete selection process is explored by analyzing each athlete's individual event scores, total scores, and rankings.

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2. Research subjects and methods

2.1. Research subjects

This study primarily conducts a comparative analysis of the selection of outstanding modern pentathlon athletes in China through the competition results of the national modern pentathlon events from 2009 to 2013.

2.2. Research methods

2.2.1. Literature review method

By searching the website of the Chinese Modern Pentathlon Association and the website of the General Administration of Sport of China, I have consulted more than 20 related articles from CNKI (China National Knowledge Infrastructure) and searched for literature and related training unit materials on Chinese modern pentathlon sports from recent years.

2.2.2. Expert interview method

On the basis of analyzing existing literature, a preliminary interview outline was drafted, and interviews were conducted with first-line modern pentathlon coaches and athletes in China through face-to-face conversations, telephone, and Tencent's messaging tools.

2.2.3. Quantitative statistical method

Quantitative statistical analysis was conducted on the competition results of major national modern pentathlon events from 2009 to 2013, as well as data related to the athletes' previous professional backgrounds before they engaged in modern pentathlon.

3. Results and analysis

3.1. The current situation of modern pentathlon athlete selection in China

The Chinese modern pentathlon national team was established in 1984. The development and registered athletes of modern pentathlon in provinces and cities across the country are much fewer compared to other sports such as swimming, track and field, and shooting. There are also many differences in the athlete selection process in the early stages. As the sport continues to develop, the selection model is gradually taking shape. According to statistics, by the 2013 National Games, most modern pentathlon athletes were selected from swimmers, while some provincial teams also selected from runners, such as Liaoning, Sichuan, Gansu, Inner Mongolia, Shaanxi, etc., and some athletes were selected from track and field runners. Athletes who are primarily skilled in shooting, fencing, and equestrian sports are generally rarely selected for training as modern pentathlon athletes. The reason is that athletes in shooting, fencing, and equestrian sports need a long time of training to possibly reach an ideal level compared to themselves in the combined running and shooting and swimming events, which are based on physical fitness. Especially in swimming, a sport that requires both physical fitness and high technical content, athletes in this event are still difficult to reach a higher level through training. Therefore, athletes from these three sports are generally not considered for selection as modern pentathlon athletes. Hence, this paper mainly compares and analyzes modern pentathlon athletes who are from swimming backgrounds and those from running backgrounds.

3.2. Performance comparison of modern pentathletes with swimming and running backgrounds

Modern pentathlon assesses the comprehensive abilities of athletes; having a weak link in any event can significantly limit their development. Therefore, only by developing all five events evenly can an athlete achieve good results. In recent years, modern pentathlon teams across the country have begun to shift their talent selection methods, increasing the recruitment of modern pentathletes from swimming athletes. This has led to the emergence of outstanding modern pentathletes such as Qian Zhenhua, Cao Zhong Rong, and Chen Qian, who have achieved good results in international competitions on multiple occasions. Qian Zhenhua's performance at the 2005 World Championships broke the record for Asian champions in world competitions, and he was once proudly referred to by Shanghai residents as "Yao Ming's height, Qian

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Zhenhua's demeanor, Liu Xiang's speed, Wang Liqin's strength," providing a good reference for the development and talent selection of modern pentathlon in China. However, to understand where the performance differences between athletes from swimming and running backgrounds lie, the following analysis will compare the best annual rankings and scores of athletes from both sports.

3.2.1. Comparison of fencing scores

In terms of men's fencing scores (Table 1), the t-test results show a significant difference ($P<0.05$) between the two groups. On average, male modern pentathletes with a swimming background scored 176 points higher than those with a running background. Additionally, comparisons reveal that in 2011 only, modern pentathletes with a running background slightly outperformed those with a swimming background in fencing by 24 points. According to surveys, neither runners nor swimmers had any experience with fencing before transitioning to modern pentathlon. The significant difference is likely due to the height, finger span, and shoulder joint flexibility of modern pentathletes with a swimming background. As for women's fencing scores (Table 2), there is no significant difference in either the average or individual annual scores ($P>0.05$).

Table 1: Comparison of Fencing Scores for Male Athletes

Athlete Background	2009Year	2010Year	2011Year	2012Year	2013Year	12th National Games	Mean
Swimming	1096	928	904	1024	928	1224	1017.33
Running	928	664	928	784	856	888	841.33

Table 2: Comparison of Fencing Scores for Female Athletes

Athlete Background	2009Year	2010Year	2011Year	2012Year	2013Year	12th National Games	Mean
Swimming	808	904	880	952	952	1216	952
Running	904	976	856	976	952	1096	960

3.2.2. Comparison of swimming scores

In the comparison of swimming scores between male modern pentathletes from a running background and those from a swimming background, the t-test results show a very significant difference ($P<0.01$). Among female modern pentathletes from the two backgrounds, the t-test results indicate a significant difference ($P<0.05$). On average, modern pentathletes with a swimming background outscored those with a running background by 188 points for males and 142.66 points for females. Additionally, in the women's swimming scores at the 12th National Games, modern pentathletes with a swimming background only outperformed those with a running background by 52 points. When looking at individual competitions, the difference is not very apparent.

Table 3: Comparison of Swimming Scores for Male Athletes

Athlete Background	2009Year	2010Year	2011Year	2012Year	2013Year	12th National Games	Mean
Swimming	1188	1332	1340	1348	1284	1364	1309.33
Running	1152	1028	1120	1028	1104	1116	1091.33

Table 4: Comparison of Swimming Scores for Female Athletes

Athlete Background	2009Year	2010Year	2011Year	2012Year	2013Year	12th National Games	Mean
Swimming	1132	1116	1112	1100	1176	1152	1131.33
Running	956	916	968	1024	968	1100	988.67

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3.2.3. Comparison of equestrian scores

In terms of equestrian scores (Table 5), the t-test results show no significant difference (P>0.05) between male modern pentathletes with a swimming background and those with a running background, with the former having a slightly higher average score by 79.33 points. In the individual annual scores of the six national competitions, male athletes from both backgrounds performed equally well. There is also no significant difference (P>0.05) in scores between female athletes from the two backgrounds, with an average difference of only 51.34 points.

Table 5: Comparison of Equestrian Scores for Male Athletes

Athlete Background	2009Year	2010Year	2011Year	2012Year	2013Year	12th National Games	Mean
Swimming	1200	1160	1160	1200	1200	1120	1173.33
Running	1024	1136	1196	1200	848	1160	1094

Table 6: Comparison of Equestrian Scores for Female Athletes

Athlete Background	2009Year	2010Year	2011Year	2012Year	2013Year	12th National Games	Mean
Swimming	1176	1200	1180	1180	1100	1200	1172.67
Running	1028	1200	1092	1088	1180	1140	1121.33

3.2.4. Comparison of combined running and shooting scores

Refer to Table 7, In the final event of combined running and shooting, the t-test results for male athletes from two different backgrounds show no significant difference (P>0.05), with the average score of modern pentathletes with a running background being only slightly higher than those with a swimming background by 12.67 points. This indicates that male modern pentathletes with a swimming background in China, through a certain period of systematic training, can perform almost as well as those with a running background in this event, reaching an ideal level. On the female side, the t-test results show a significant difference (P<0.05), with the average score of modern pentathletes with a running background being 182 points higher than those with a swimming background. This suggests that there is still a certain gap between female modern pentathletes with a swimming background and those with a running background in the combined running and shooting event scores.

Table 7: Comparison of Combined Running and Shooting Scores for Male Athletes

Athlete Background	2009Year	2010Year	2011Year	2012Year	2013Year	12th National Games	Mean
Swimming	2484	2228	2244	2320	2304	2276	2309.33
Running	2484	2344	2024	2400	2360	2320	2322

Table 8: Comparison of Combined Running and Shooting Scores for Female Athletes

Athlete Background	2009Year	2010Year	2011Year	2012Year	2013Year	12th National Games	Mean
Swimming	1812	1672	1876	2048	1956	2000	1894
Running	2088	2052	2096	2108	2016	2096	2076

3.2.5. Ranking and total score analysis

From 2009 to 2013 (Table 9), in a total of 6 national competitions, modern pentathletes with a running background only won the championship once and made it into the top three 4 times; modern pentathletes with a swimming background won all the championships in the 6 national competitions, except for the women's event in 2010. This indicates that selecting modern pentathletes from swimmers has an advantage

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over selecting from runners and skill-dominated athletes. At the same time, based on the individual scores from Tables 1 to 8, the total average scores of male modern pentathletes with a swimming background and those with a running background in the six national competitions are 5808.99 and 5378.66 points, respectively. The gap between male modern pentathletes with a running background and those with a swimming background is significant. This also shows that modern pentathlon assesses the comprehensive competitive ability of athletes, where scores in individual events accumulate to determine the final significant score differences. The gap between female athletes from different backgrounds is not obvious; that is, the total average scores of female modern pentathletes with a swimming background and those with a running background in the six national competitions are 5150 and 5146 points, respectively, with little difference in total scores. In the competition of swimming and combined running and shooting events, the average scores of these two individual events are also similar. By consulting and comparing the scores of male and female athletes in the "2014 Modern Pentathlon World Cup Final," it can be found that China's outstanding male modern pentathletes with a swimming background can achieve world-class swimming scores, and other scores are close to the world-class level. Based on the standard of national-level swimmers, the average level of outstanding male modern pentathletes with a swimming background can all reach the national-level swimming standard. Runners have a significant gap, especially in the swimming event, where the average swimming level is still some distance from the national second-level swimming standard. Modern pentathletes selected from the swimming project, the average level of female athletes is still some distance from the national first-level swimming standard, forming a sharp contrast with outstanding male athletes with a swimming background. This indicates that the physical fitness and physical function indicators of female modern pentathletes selected from the swimming project in China are relatively low. Therefore, in the selection of female athletes, it should be closer to the selection of male athletes, and some female athletes with higher swimming levels should be selected. Even if other projects have an advantage, it is almost impossible for outstanding female modern pentathletes selected from runners to reach the national first-level swimming standard. Years of practice have also proven that this has never happened, causing a short board in the five events. This is also the important reason why Chen Qian, an outstanding female modern pentathlete with a swimming background, can achieve rankings in world competitions, while outstanding female modern pentathletes with a running background have not achieved good results in world competitions.

Table 9: Statistical Table of Individual Champions in the National Modern Pentathlon Championships and the 12th National Games from 2009 to 2013

Event	Fencing	Swimming	Equestrian	Shooting	Shooting	Total
Male	0	6	0	0	0	6
Female	0	5	0		0	6
Total	0	11	0		0	12

3.3. The advantage of selecting outstanding modern pentathlon athletes from swimmers

3.3.1. In terms of points - there is no upper limit

In modern pentathlon competitions, only swimming and combined running and shooting are events where points are uncapped. Both events calculate scores based on time, with fewer seconds resulting in higher scores. For example, in the swimming event, both men and women have a benchmark time of 2 minutes and 30 seconds, which is worth 1000 points. For every 0.33 seconds faster or slower than this time, 4 points are added or subtracted. In the combined running and shooting event, completing it within 14 minutes earns 2000 points, and for every second faster or slower, 4 points are subtracted or added. It can be seen that the swimming event has a certain point advantage among the two uncapped point events, meaning the faster the completion, the higher the points obtained, and vice versa, the more points are deducted.

3.3.2. Psychological aspect - primacy effect

After the 2008 Beijing Olympic Games, in order to improve spectator appeal, the rules were modified, with the most significant change being in the combined running and shooting event. As shown in Table 10,

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Chen Qian, an outstanding female modern pentathlete from China, had average performance in running and shooting before the rule change, which were not particularly outstanding. After the rule change, she has achieved great results in national and world competitions on multiple occasions. This indicates that the advantage of the running event has decreased after the new rule change, and the level of shooting has played a significant role.

Table 10: Chen Qian's Performance Comparison After the Implementation of New Rules

	Fencing	Swimming	Equestrian	Shooting	Shooting
2008	944	1116	1132	1012	1120
2009	1000	1120	1156		2654
Increase/Decrease	+56	+4	+24		+432

Shooting mainly tests the athlete's stability, requiring the athlete to maintain a calm mindset, neither rushed nor impatient, as good performance can only be achieved in a quiet state. Therefore, a good mental state has become a key factor in determining shooting scores. After the rule change, the swimming event was moved up from the third to the second position, which, in terms of psychological advantage, has improved. The rules stipulate that those with better results in the first three events start earlier, and the quality of their performance in these events plays a crucial psychological role in the subsequent combined running and shooting event. The comparison mentioned above shows that athletes who switch to modern pentathlon from swimming have significantly higher scores in each event, especially in swimming, where their advantage is very obvious. Since modern pentathlon uses a "catch-up" start in the final combined running and shooting event, the quality of the psychological state will have a certain impact on the stability of shooting performance in that event. Modern pentathletes with a running background have lower scores, as shown above, causing them to start later, which means they have to try their best to catch up in order to achieve a good ranking, leading to rapid breathing, increased heart rate, and an impatient mindset, all of which are taboos in shooting. Therefore, this results in runners finding it difficult to gain an advantage in this event after the rule change.

3.3.3. Technical aspect - long-standing

According to traditional perceptions, swimmers engaging in running events face limitations due to softer ankle joints, underdeveloped lower limb strength, and poor joint support capabilities, which can lead to sports injuries and limit their development in running. However, as analyzed above, among athletes who transitioned from swimming to modern pentathlon and won championships, no sports injuries have been observed, and with proper and scientific training, they can achieve a high level of performance in running as well. Compared to running, swimming requires more stringent physical qualities, such as breathing under water pressure and the flexibility of the upper limbs and shoulder girdle, which are more demanding than those for running. This is a significant factor why track and field athletes find it difficult to reach a high level in swimming. After a certain period of training, male swimmers who transitioned to modern pentathlon, aside from a slight gap in the combined running and shooting event, outperformed runners in all other events ($P<0.05$), with their swimming scores significantly higher than those of modern pentathletes with a running background ($P<0.01$), and their average total scores were much higher than those of track and field athletes. In terms of rankings, as shown in Tables 11 and 12, the t-test indicates a significant difference ($P<0.05$) between the two groups, with more stable rankings and achievements in major competitions. The difference for women is not significant ($P>0.05$). Possibly due to selection factors, the development of competitive levels for modern pentathletes transitioning from running is severely constrained. The main reason may be that both swimming and running require high lung capacity, and swimming is a skill that is gradually developed through long-term accumulation of training to reach a higher level, while running is an innate human skill. Therefore, modern pentathletes with a running background, like those with a background in shooting or fencing, may have some advantages in the combined running and shooting event, but their swimming scores are hard to improve to a high level, creating a short board in this comprehensive sport, affecting their development. Additionally, track and field athletes' lack of upper limb and shoulder girdle flexibility, ankle joint flexibility, and upper limb strength pose significant difficulties in learning to swim. In

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competitive swimming events, such as the 200m freestyle which focuses on speed and endurance, there are high demands on athletes' energy distribution and movement rhythm. Although runners have a natural advantage in lung capacity compared to athletes in other events like shooting or fencing, their drawbacks in learning to swim include stiff ankles, poor shoulder flexibility, weak upper limb strength, and lack of explosive power, especially in older athletes, where flexibility training is hard to make up for these deficiencies, which are fatal in learning to swim and in the 200m freestyle event. Therefore, for middle and long-distance runners who do not know how to swim or only know a little, it is easy to complete the 200m freestyle, but it is extremely difficult to achieve high scores, and their results are hard to reach a high level.

Table 11: Male Athletes' Annual Rankings

Athlete Background	2009Year	2010Year	2011Year	2012Year	2013Year	12th National Games
Swimming	1	1	1	1	1	1
Running	5	15	14	17	22	12

Table 12: Female Athletes' Annual Rankings

Athlete Background	2009Year	2010Year	2011Year	2012Year	2013Year	12th National Games
Swimming	1	3	1	1	1	1
Running	3		2	4	2	5

4. Conclusion

Athletes who achieved rankings in the six national competitions all came from swimming and running backgrounds.

In the comparison of performance scores, male modern pentathletes with a swimming background, except for a slight lag in the combined running and shooting event compared to male modern pentathletes with a running background ($P>0.05$), outperformed in all other individual events ($P<0.05$) and overall scores, significantly higher than male modern pentathletes with a running background. Their swimming scores were significantly higher than those of modern pentathletes with a running background ($P<0.01$). There was no significant difference in the total scores between female athletes from different backgrounds, and among individual events, only the combined running and shooting event and swimming showed significant differences ($P<0.05$), with no significant differences in the other two events.

In the annual ranking statistics, male modern pentathletes with a swimming background were more stable than male modern pentathletes with a running background, winning all the championships recorded, which is significantly better than male modern pentathletes with a running background. The difference in the women's events was not significant ($P>0.05$).

With proper scientific training, modern pentathletes with a swimming background can reach the same level as those with a running background in the combined running and shooting event.

Adjust the direction of talent selection comprehensively, and fully implement the strategy of selecting outstanding modern pentathletes from high-level swimmers, no longer selecting outstanding modern pentathletes from athletes in sports other than swimming.

Adjust the talent selection strategy for female modern pentathletes, taking China's outstanding male modern pentathletes as a reference, to increase the selection of outstanding modern pentathletes from high-level female swimmers.

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