

# Study on the Achievement Factors Affecting China High Level Javelin Thrower Competition

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## Abstract

This study aims to analyze the factors influencing the success of high-level javelin throwers in China. Using a qualitative research method with a case study approach, the research focuses on the competition experiences of Chinese Olympic javelin athletes who have won Olympic gold medals. This study conducts an in-depth analysis of the factors affecting the success of javelin athletes in China. The research methodology includes interviews with six experts and coaches, as well as individuals involved with China's Olympic javelin athletes, who serve as the primary sources of information for this study. The research tools include in-depth interviews and case analysis, and qualitative data analysis methods are used to process and synthesize the collected data. The key factors influencing the success of high-level javelin throwers in China are identified as four main factors: physical, technical, psychological, and social. These factors work together to determine the athletes' performance in competitions.

**Keywords:** Javelin; High Performance Athlete; Major Competitions; Influencing Factors

## Introduction

As a representative throwing event in track and field that combines technical complexity with high physical demands, the improvement of competitive performance in javelin requires the synergistic integration of multidisciplinary factors such as biomechanics, training science, and psychology. In recent years, with the rapid advancement of global javelin performance (the world record was elevated to 98.48 meters in 2017), Chinese athletes have achieved notable successes in international competitions such as the Asian Games and World Championships (e.g., Liu Shiying's gold medal at the 2020 Tokyo Olympics). However, their overall performance remains volatile, with a significant gap persisting compared to world-class athletes (data from the General Administration of Sport of China in 2022 shows that the average performance of China's top 10 male javelin throwers lags 6.8 meters behind the global elite). This underscores the necessity to systematically investigate the key factors influencing the competition performance of China's elite javelin athletes.

Existing research indicates that javelin performance is directly affected by biomechanical factors such as kinetic chain efficiency in technical movements (e.g., hip-

shoulder velocity differential during the final thrust phase), sport-specific strength qualities (core rotational explosiveness), and implement flight parameters (optimization of release angle and attack angle) (Wang Xiang, 2020). Additionally, psychological regulation plays a critical role in performance under high-pressure scenarios (Zhang, 2018). Notably, the 2018 World Athletics rule revision shifting the javelin's center of gravity forward by 4 cm significantly altered flight dynamics, posing new challenges to athletes' technical adaptability. While domestic scholars have conducted kinematic studies (Li et al., 2020), most focus on isolated factors, lacking systematic integration of technical, physical, psychological, and environmental elements. Furthermore, empirical research on Chinese athletes' competitive characteristics under the new regulations remains scarce.

This study aims to analyze the factors influencing the competitive performance of China's elite javelin athletes through multidimensional empirical analysis. The findings will provide theoretical foundations for refining China's scientific training system and developing personalized competition strategies, offering practical value for enhancing the consistency of athletes' performance in international events.

### Research Objectives

To study factors influencing the achievements of Chinese high-level javelin.

### Literature Review

**Research on Classification of Influencing Factors:** Athletes' performance in competitions is shaped by seven interrelated elements: function, form, physical fitness, technique, tactics, intelligence, and psychological capacity. Professor Zhong Bingshu defines competitive strength as the objective capability directly linked to victory, primarily reflected in athletes' technical and tactical proficiency, physical condition, form, functional capacity, and psychological/intellectual levels. Subjective strength, rooted in mental state, integrates and amplifies these qualities to form comprehensive power (Zhou, 2021). In 2021, Jiang Xudong developed an evaluation framework for the factors influencing Chinese women's Olympic performance, structured into three primary indicators (socio-cultural context, sports training, and competitive support), ten secondary indicators (socio-political, historical-cultural, economic, training, coaching, athlete, competition, management, scientific research, and logistical support factors), and 27 tertiary indicators.

**Research on Physical-related Factors:** Lü Gang, coach of China's national javelin team (2018), emphasized that comprehensive physical training is pivotal for enhancing performance and ensuring sustainable development. Javelin demands exceptional speed and strength, with training phases tailored to prioritize power and velocity development. Edouard P. (2018) highlighted the significant impact of age and injuries on competitive outcomes. Chen Liang (2022) further asserted that physical fitness—particularly explosive and speed strength—directly determines javelin performance, making it a cornerstone of success.

**Research on Technical-related Factors:** Technical proficiency is a decisive factor in javelin performance. Stability of technique, movement coordination, and optimal force application directly influence throwing distance. Refining these details requires long-term training and meticulous adjustments (Liu Xiang, 2016). Improper preparatory postures during the grip phase severely undermine technical execution (Wang Xiang, 2020). Elite athletes focus on minimizing the "full bow" moment (the final two steps and force application phase), as shorter durations correlate with greater efficiency. Additionally, hand speed during release significantly impacts outcomes (Liu Xin, 2017).

**Research on Psychological-related Factors:** Psychological state plays a critical role in athletic performance. Under high-pressure competition, stress, anxiety, and self-confidence levels profoundly affect outcomes. Thus, mental conditioning is as vital as technical and physical training (Zhang Bin, 2018). China should prioritize psychological resilience training to help athletes adapt to diverse competitive scenarios and enhance tactical execution through cognitive-behavioral integration (Zhang, 2012). To excel, elite javelin athletes must holistically integrate technical, physical, and psychological factors while leveraging technological advancements to elevate competitiveness (Zhou Long, 2021).

**Research on Social-related Factors:** National policies, logistical support, and training objectives significantly shape training efficacy (Zhang, 2012). Gao Qianqian (2018) analyzed the interplay of intrinsic motivation (driven by personal aspirations) and extrinsic motivation (fueled by external rewards like praise and recognition). Cultivating balanced motivation—aligning personal goals with external incentives—is essential for peak performance. Technological advancements, from equipment innovation to data analytics, empower coaches and athletes to optimize training strategies and competitive decision-making.

China's recent international breakthroughs in women's javelin stem from the synergy between systemic training and policy support, necessitating balanced integration of multidimensional factors: physical fitness, technique, psychology, and socio-institutional resources. Current research predominantly isolates domains (e.g., strength training or technical refinement), neglecting systemic analysis of policy support, collectivist cultural dynamics, and multi-factor interactions. Future efforts must establish interdisciplinary frameworks combining technical innovation, psychological interventions, and institutional reforms to overcome the "overemphasis on physicality over synergy" challenge and ensure sustainable development.

## Research Methodology

### Research Subjects

In the realm of competitive sports, enhancing the performance of China's elite javelin athletes is of critical importance. This study focuses on identifying the key factors influencing their competition outcomes, exploring how these factors are hierarchically structured and interact. Specifically, it investigates influencing elements across four

dimensions: physical attributes (e.g., strength and biomechanics), technical execution (e.g., kinetic chain efficiency), psychological regulation (e.g., mental resilience under pressure), and sociocultural dynamics (e.g., training environments and institutional support). By systematically dissecting these dimensions, the research aims to provide a comprehensive framework to advance China's javelin performance through theoretical and practical insights.

#### Research Tools

The primary research tool involves in-depth interviews with domain experts, supplemented by qualitative data analysis methods to process and synthesize the collected data.

#### Data and Analysis

This study employed a literature review method to identify tiered influencing factors (Levels 1-3) affecting competition success among China's elite javelin athletes. These factors were subjected to expert validation through Delphi techniques, followed by in-depth expert interviews to empirically validate their impact on competitive achievement. The triangulation of literature-derived frameworks and qualitative insights ensures methodological rigor in mapping the multifactorial determinants of performance.

#### Research Scope

This study adopts a qualitative research design. First, a systematic review of nearly 100 Chinese and English publications was conducted using literature analysis to identify key variables across four core factors through content analysis, establishing the theoretical foundation. Second, semi-structured expert interviews (see Table 1) were administered to six Chinese coaches with national team coaching experience, sports medicine specialists, and authoritative scholars. Finally, the Analytic Hierarchy Process (AHP) was integrated to construct a hierarchical model, which ensures theoretical rigor and enhances practical applicability.

**Table 1** : Basic information about the interview experts

S/N	Name	Gender	Work unit	Javelin experience
1	Guo**	Lady	Chinese athletics teams	Head Coach of the Chinese National Javelin Throw Team
2	Chen*	Man	Chinese athletics teams	Strength and Conditioning Coach of the Chinese National Javelin Throw Team
3	Wang* *	Lady	Chinese athletics teams	Team Doctor of the Chinese National Team
4	Li **	Lady	University Of Yantai	Associate Professor and Javelin Teacher with five years of teaching experience, who placed second at the 2017 London World

S/N	Name	Gender	Work unit	Javelin experience
				Championships with a personal best of 66.25 m.
5	Zhou* *	Man	Xi'an Institute of Physical Education	Holder of a professorship, led over five national javelin research projects, authored over three peer-reviewed articles on javelin biomechanics, and served as director of the Olympic research team.
6	Wang*	Man	Xi'an Institute of Physical Education	Associate Professor, led over three national javelin research projects, authored over three peer-reviewed javelin-related articles, and served as a member of the Olympic research team advising Liu.

## Research Results

Based on the Analytic Hierarchy Process (AHP) proposed by Thomas L. Saaty, a more detailed division and exploration of these four first - level influencing factor dimensions are carried out. Table 3 is compiled by the author after consulting a large number of relevant literatures and incorporating the supplementary opinions of experts. It covers the specific factors affecting the competition performance of Chinese javelin throwers. This paper classifies these influencing factors into four levels and explains each level of factors. The table shows the details of the classification of the influencing factors at the first three levels, and the fourth - level influencing factors will be further studied and analyzed in subsequent papers.

**Table 2 :** Factors Affecting the Competition Achievements of High-Level Javelin Athletes

First-level factors	Secondary factors	Three-level factors
Body factors	Five major physical fitness factors	Power
		Speed
		Endurance
		Sensitive quality
		Flexibility quality
	Pre-competition adjustment training	Technical factors
		Body factors
	Age and gender	Age factor
		Gender factors (M/W)
	Health and injury	Illness

First-level factors	Secondary factors	Three-level factors	
		Athletic injury	
Technical factors	Technical level	Start action	
		Running skills	
		Throwing action	
		Personalized technology	
	Special ability	Specific speed	
		Specific strength	
Special throwing ability			
Psychologic factor	Emotional factor	Anxiety and stress	
		Excitation and pleasure	
	Motivational factor	Internal motivation	
		External motivation	
	Cognitive factors	Self-confidence	
		Focus	
		Goal setting	
	Personality factors	Personality factors	
		Emotional stability	
		The ability to cope with stress	
	Social factors	Social support	Family factors
			Coach team
Companion support			
Sociocultural environment		Sports culture	
		Social concept	
Economic factors		Financial support	
		Infrastructure	
Policy system		Government policy	
		Competitive system	

The competitive growth of Chinese high-level javelin athletes is comprehensively influenced by various factors. These influencing factors are divided into three levels, with a total of 55 influencing factors. Specifically, there are 4 categories of first-level influencing factors, 14 categories of second-level influencing factors, and 37 categories of third-level influencing factors.

## 1. Analysis of Physical Factors

### (1) Analysis of the Five Basic Physical Qualities

**Table 3 :** The fourth-level factors affecting athletes' competition results

First-level factors	Secondary factors	Three-level factors	Four factors	explanation
Physical factors	Five major physical fitness factors	Power	Equivalent strength	Power and control
			Strength endurance	Capacity for stable support and explosive force generation
			Dynamic force	Maximum muscle strength
			Upper limb strength	Capacity for rapid explosive power generation
		Lower limb strength	Maintain a stable power output	
			Maximal force	Capacity for sustained high-power output over extended durations
			Explosive effort	Capacity for efficient and rapid force production and regulation
		Velocity	Reaction speed	Capacity for rapid speed adjustment
			Start speed	Acceleration capability after startup
			Speed endurance	Maintaining high velocity while mitigating fatigue
			Accekerating ability	Capacity for rapid acceleration and explosive power generation
			Maximum speed	top speed
		Endurance	Mixed endurance	Capacity for efficient recovery and sustained performance
			General endurance	Maintaining training intensity and rapid recovery capacity
			Endurance for Specialized training	It directly impacts athletic performance and movement stability during competition.
		Sensitive	Balanced capacity	Capacity for maintaining body stability
			Harmony	Intersegmental coordination capacity
			Reaction sensitivity	Capacity for rapid response to external stimuli
			Dynamic flexibility	Rapid postural adjustment for enhancing movement flexibility



First-level factors	Secondary factors	Three-level factors	Four factors	explanation
		Pliable and tough	Muscle flexibility Joint flexibility	Improving muscle elasticity while preventing athletic injuries Enhancing joint range of motion and optimizing movement fluidity

According to Table 3 above, among the physical fitness factors, there are 5 third - level factors and 21 fourth - level factors. Among them, strength quality encompasses 7 fourth - level factors, speed quality includes 5, and endurance, agility, and flexibility qualities each have 3 fourth - level influencing factors.

Overall, the competition results of javelin athletes do not rely solely on a single physical quality but are the result of the coordinated development of multiple qualities such as strength, speed, endurance, agility, and flexibility.

## (2) Analysis of Pre-Competition Adjustment Training

Pre-competition adjustment training is a customized exclusive training plan specifically formulated by the coaching team based on the individual conditions of athletes and in combination with the scale of the competition. The specific factors are shown in Table 4.

**Table 4: Quaternary Factors of Pre-Competition Adjustment Training**

First-level factors	Secondary factors	Three-level factors	Four factors	explanation
Physical factors	Pre-competition preparatory training	Technology	Stable technology Improve special capabilities	Adjusting and modifying techniques prior to competition Enhancing Throwing Proficiency Prior to Competition
		Body	Injury prevention training Adjust your body's excitement state	Mitigating the Impact of Athletic Injuries on Competition Performance Optimizing physical conditioning through training to achieve peak performance during competition

It can be seen that pre - competition adjustment training includes 2 third - level factors, and there are 4 main fourth - level factors. Pre - competition adjustment training is formulated based on the physical condition and technical level of athletes, with the aim of helping athletes achieve excellent results in the competition.

## (3) Analysis of Age and Gender Factors

Gender and age are significant physiological factors influencing athletes' competitive performance. As athletes age, their physiological functions gradually decline, impacting strength, recovery capacity, and neuromuscular coordination. For further details, refer to **Figure 1** below.

**Table 5: Quaternary Factors of Age and Gender Influence**

First-level factors	Secondary factors	Three-level factors	Four factors	explanation
Physical factors	Age and gender	Age	Juvenile era (From 13-18 years old)	Growth stage
			Adolescence (From 19 to 24 years old)	Peak competitive phase
			Adult stage (From 25 to 30 years old)	Peak performance state
			Middle age (From 31 to 35 years old)	Despite declining physical fitness, he remained highly experienced.
		Gerontic (Age: 36 years old and older)	Substantial decline in athletic performance	
		Sex (M/W)	Physical differences	Males tend to exhibit greater strength capabilities compared to females on average.
			Physiological differences	Females tend to demonstrate superior flexibility and endurance capacity compared to males on average

#### (4) Analysis of Health and Injury Factors

Factors In the competitive performance of high - level javelin athletes, the influence of health and injury - related factors cannot be underestimated. The physical health of athletes is directly related to their training effects, recovery abilities and performance in competitions. Table 6 below shows the fourth - level factors related to health and injury - related factors.

**Table 6: Classification of Health and Injury Factors**

First-level factors	Secondary factors	Three-level factors	Four factors	explanation
Physical factors	Health and injury	Illness	Organic disease	Morphological remodeling of organs



First-level factors	Secondary factors	Three-level factors	Four factors	explanation
		Athletic injury	Functional disease Injury of joint Bone injury Muscle and tendon injuries Nerve damage Injury of blood vessel	Exhibited no observable morphological alterations while demonstrating physiological dysfunction Dislocations et al Fractures et al Muscle strain, etc Neurocompression et al Hemorrhage et al

In summary, there are a total of 4 secondary - level factors, 11 tertiary - level factors, and 39 quaternary - level factors that affect the physical condition of athletes.

## 2. Analysis of Technical Factors

Javelin throwing is a sport that combines complexity and a high degree of technicality. In high - level competitions, technical factors play a decisive role in the performance of athletes. The specific influencing factors are as follows:

**Table 8:** Classification of Technical Influencing Factors

First-level factors	Secondary factors	Three-level factors	Four factors	explanation
Technical factors	Technology horizontal	Start action	Start the pace Start to accelerate Center of gravity control	
		Running skills	Run-up technical coherence Center of gravity height change One step in length Rate of stride Step adjustment	Four sequential concluding steps Vertical height of the human center of gravity above the ground Optimizing approach technique for kinematic chain harmony and biomechanical efficiency
		Throwing action	Power coherence	The angle between the shooting gun and the ground when it is

First-level factors	Secondary factors	Three-level factors	Four factors	explanation	
			Power timing	being held in the ready position before firing	
			Out of the gun	The optimal moment to grip	
			Angle	Kinetic chain synchronization for optimal force transmission	
			The speed of the gun	Flexibility, muscle strength, etc	
			Personalized technology	Out of the gun height	Body height, arm span, weight, etc
				Physical qualifications	Vertical displacement of the hand-grip position above the ground during firearm release
	Special ability	Specific speed		Physiological function	Initial projectile velocity at the moment of firearm release
				Throw maximum speed	Maximizing projectile flight distance through kinetic chain synchronization and force transmission
		Specific strength		Hurling coherent speed	Maximizing kinetic energy conversion through kinetic chain synchronization enhances speed-power development
				Hurling power	Requisite muscular strength during the throwing motion
Special throwing ability			Speed force	Maximizing integrated force application through kinetic chain synchronization	
			Throwing range	Maximum speed ability	
			Release speed	Maximizing projectile velocity through kinetic chain synchronization	

The technical factors affecting the competitive level of javelin athletes, there are 2 secondary - level factors, 7 tertiary - level factors, and 21 quaternary - level factors.

**Table 9:** Angle, speed and height of the outgoing gun

The Angle of the gun	The speed of the gun	The height of the gun
35°-45°	30m/s-35m/s	1.8m-2.5m



Based on the data analysis of international javelin competitions in Table 9, international experts point out that under idealized analysis, the release angle of the javelin is generally between  $35^{\circ}$  -  $45^{\circ}$ , and the optimal range is  $36^{\circ}$  -  $42^{\circ}$ . Within this range, the javelin can achieve the maximum flight distance. The optimal release speed is between 30m/s - 35m/s. If the speed is too low, there will be insufficient power, and if it is too high, the stability will be poor. The release height should be controlled between 1.8 meters - 2.5 meters. If the release angle is too high, the throwing trajectory will be too high, affecting the throwing distance. An ideal balance needs to be achieved among the angle, speed, and height to give full play to the strength and technical advantages of athletes and achieve the best throwing effect.

### 3. Psychological Factors Analysis

In high - level javelin competitions, the psychological factors of athletes have a significant impact on their performance.

**Table 10: Psychological Factors**

First-level factors	Secondary factors	Three-level factors	Four factors	explanation
Psychological factors	Emotional factor	Anxiety and stress	Anxiety before the game Skills anxiety  Self stress  External pressure Pressure of competition	Anxiety about suboptimal athletic performance induces psychological tension Anxiety regarding suboptimal technical execution during competitive matches Competitive stress induced by rival competition Self-induced tension due to elevated self-expectations Performance-related stress induced by external expectations from coaches, teammates, or family members
		Excitation and pleasure	Social pleasure  Enjoy the process	Positive affect and social support derived from interpersonal interactions with teammates and coaching staff in athletic contexts Passion for the sport fosters positive affect and self-fulfillment during athletic engagement

First-level factors	Secondary factors	Three-level factors	Four factors	explanation
			Achievability  The game excited	Academic achievement fostering psychological satisfaction through self-efficacy reinforcement Intrinsic motivation and passion during competitive performance correlate with enhanced athletic outcomes
	Motivational factor	Internal motivation  External motivation	Challenging  Interest Social recognition Honour Money award	Competitive rivalry versus self-overcoming: Passion and dedication to the javelin sport  Winning awards and titles Social recognition, social status, etc
	Cognitive factors	Self-confidence  focus  Goal setting	Efficacy  Confidence in the game Technical confidence Process focus Focus in the game Training focus Long-term objectives Medium-term target	Self-efficacy in the successful execution of javelin throwing technique Self-regulation of competitive stress through intrapersonal coping mechanisms You can be confident in achieving your predetermined goals in the competition. Focus on their own competition and the technology showcase. Focus in training Focus on executing the throwing action. Each time, daily, weekly training objectives, etc In October, the season breakthrough goals, etc



First-level factors	Secondary factors	Three-level factors	Four factors	explanation
			Short-term goal	Win international awards or elevate the level of sports, etc.
	Personality factors	Personality factors	Competitiveness Automatic rhythmicity Toughness	The strong desire to win and fear of losing in the game. Maintain high self-standards.
		Emotional stability	Pre-match stability Emotional control during the race Emotional regulation	The ability to stay positive when facing setbacks. Control your emotions, stay focused, and play consistently. Focus on preparation before the game. Reduce tension before the game.
		The ability to cope with stress	Pre-competition pressure management External pressure response Stress management during the game.	The ability to calm down quickly and refocus on the game after making mistakes. Be responsive to public expectations. Stay calm and focused at critical times.

Psychological factors include 4 secondary - level factors, 10 tertiary - level factors, and further - subdivided quaternary - level factors amount to 32.

#### 4. Social Factors Analysis

National policies, coaching teams, training facilities, social support, and financial guarantees, etc., can all affect the training conditions, psychological states, and competition performances of athletes.

**Table 11: Social Factors**

First-level factors	Secondary factors	Three-level factors	Four factors	explanation
Social factors	Social support	Family factor	Psychological support	Training fees, equipment, competition funds, etc.
			Cultural atmosphere	Ensure the athletes have no worries at home.
			Time management and planning.	Help athletes adjust their mindset
			Emotional support	Relieve anxiety and stress
	economic support	Affect the athletes' attitudes toward training and competition		
Train team			Encourage and motivate	Help athletes adjust and continuously surpass themselves.
			Tactical instruction	Develop competition strategies, and so on.
			Psychological service	Enhance self-confidence, concentration, and emotional management skills.
Companion support			Training planning	The coaching team is responsible for developing personalized training plans.
			Technological guidance	Continuously optimize the technique and improve throwing skills, etc.
			Mutual assistance in the game	Reduce stress and anxiety, and maintain a positive attitude.
Sociocultural	Sports culture	Sports culture	Psychological support	Mutual supervision and competition to enhance training effectiveness and motivation.
			Training cooperation	Emotional support and technical guidance to boost confidence and team cohesion.
			Teammate support	The mutual cooperation between the players and the coaching team.
			Training culture	Fair competition, respect for rivals, etc
			Competition culture	A rigorous training attitude and positive atmosphere within the team.

First-level factors	Secondary factors	Three-level factors	Four factors	explanation
	environment		Team culture	During the game, the players' encouragement kept me focused and excited.
		Social concept	Celebrity effect Sports sense of achievement Competitive value	Sports stars and social role models promoting the development of javelin. Glory and pride strengthen the cultural value of sports. Society pays close attention to the performance of javelin athletes in international competitions.
Economic factors	Financial support		Bonus and rewards Corporate sponsorship Government funding	The motivational effect of event prize money and rewards. Companies provide financial support to athletes and events. Special funding from national and local governments for javelin projects.
		Infrastructure	Technology support facilities Field of Play Training facilities	Such as motion analysis equipment, data monitoring, and so on. The construction and maintenance of professional javelin throwing facilities. National and local facilities provide professional training grounds and equipment for javelin athletes.
Policy system	Government policy		Sports talent introduction policy Athletes' support program Sports development policy	Support the selection, training, and recruitment of high-level athletes to improve the overall standard of javelin events. The government supports the training and living needs of elite javelin throwers by establishing special funds and providing scholarships. State policy support for the javelin program.
		Competitive system	Competition organization and platforms.	National selection and training system for javelin athletes.

First-level factors	Secondary factors	Three-level factors	Four factors	explanation
			Competitive team management	Provide a platform for athletes to participate in both domestic and international events.
			Institutional selection and training	The national or provincial teams provide systematic training and technical support to high-level athletes.

The social factors affecting the competition performance of javelin athletes, there are 4 secondary - level dimensions, 9 tertiary - level dimensions, and when refined to the quaternary - level dimensions, there are 32.

Synthesizing the factors affecting the competition performance of high - level Chinese javelin athletes, there are a total of 4 primary - level factors, 12 secondary - level factors, 37 tertiary - level factors, and 124 quaternary - level factors.

## Discussion

The discussion below addresses the research findings through four dimensions: physical, technical, psychological, and social factors.

**Physical factors:** Demonstrate that strength (explosive power, lower-limb stability), speed (acceleration, maximum velocity), and endurance (specialized and mixed) synergistically underpin performance. Age-related physiological decline (e.g., reduced explosive power post-30) and injury risks (respiratory, musculoskeletal) critically impact competitive longevity. Pre-competition adjustment training optimizes neuromuscular coordination and injury prevention, ensuring peak performance states.

**Technical factors :** Hinges on biomechanical precision in starting posture, run-up rhythm (step-length optimization), and force-transmission efficiency during the throw. Personalized training tailored to athletes' physiques enhances power output and reduces injury risks. Specialized abilities, such as rapid run-up acceleration and precise release timing, directly correlate with javelin flight dynamics.

**Psychological factors :** Including stress management, intrinsic motivation, and emotional stability, mediates performance under pressure. Athletes with high self-efficacy and focus regulation exhibit superior technical execution, while excessive anxiety disrupts movement automation. Cognitive strategies, such as goal-oriented mental rehearsal, enhance competitive consistency.

**Social factors :** Family support, coaching teams, and policy frameworks—form the foundation for athlete development. Financial investments and infrastructure ensure access to advanced training, while cultural recognition elevates javelin's societal value. Collaborative coaching (technical, psychological, medical) and peer dynamics foster resilience and innovation.

These findings highlight the interdependence of biomechanical precision, psychological adaptability, and socio-structural support. Future interventions should integrate multidisciplinary approaches, emphasizing age-specific training, technical customization, and mental conditioning, to bridge China's performance gap in global javelin athletics.

## Conclusion

1. Physical fitness and specialized training are crucial for the performance of high-level javelin athletes. Systematic training and pre-competition adjustment training help maintain competitive status, but health management and injury prevention are key challenges.

2. Refined technical improvement and personalized training enable athletes to stand out in competitions. Continuous optimization of technical abilities is essential for improving performance.

3. Good mental qualities and effective self-regulation abilities help athletes stay calm under pressure and cope with personal expectations, failure, and injuries.

4. Multidimensional social support, including family, coaching teams, peer support, and policy protection, provides significant backing for athletes' success and promotes the development of the javelin event.

## Recommendations

High - level Chinese javelin throwers should strengthen comprehensive physical fitness training, especially emphasizing the coordinated development of strength, speed, and endurance. Technical training should be flexibly adjusted according to the individual characteristics of athletes to improve the efficiency of technique application and reduce the risk of injury. Meanwhile, athletes must pay attention to psychological adjustment and effectively control anxiety and pressure during competitions. Social support is also crucial, as it comes from families, coaches, and teammates and contributes to athletes' psychological resilience and performance.

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