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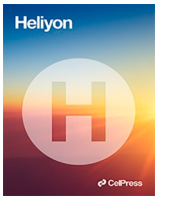

Research article

Factors influencing sports performance: A multi-dimensional analysis of coaching quality, athlete well-being, training intensity, and nutrition with self-efficacy mediation and cultural values moderation

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ABSTRACT

This study examines the dynamic relationships between cultural values, training intensity, nutrition, self-efficacy, and coaching quality on Chinese athletes' performance. Bandura's social cognitive theory and cultural psychology ideas enlightened the multi-faceted sports performance analysis. A detailed questionnaire was employed to obtain data from 880 athletes from various places and sports backgrounds. Structural Equation Modeling (SEM) was used for empirical analysis. The results show a significant positive association between coaching quality ($\beta = 0.62$, $p < 0.001$), athlete well-being ($\beta = 0.48$, $p < 0.001$), training intensity ($\beta = 0.55$, $p < 0.001$), nutrition ($\beta = 0.42$, $p < 0.001$), self-efficacy ($\beta = 0.57$, $p < 0.001$), and sports performance. Coaching quality appeared as a critical component. Athletes performed better when they felt their instructors were performing better. Diet, training intensity, and health affected athletes' performance, highlighting the necessity for athlete development. Athletes' confidence in their performance is mediated by coaching, well-being, training, nutrition, and performance. These correlations were further impacted by cultural values, highlighting the need to consider cultural context while attempting to enhance athlete performance outcomes. The study concludes that cultural values, self-efficacy, training, nutrition, coaching, and health are crucial to Chinese athletes' success.

1. Introduction

The examination of sports performance has received considerable focus in recent years, indicating a more comprehensive comprehension of the various factors contributing to an athlete's achievement. This interest extends beyond physical education and sports science to psychology, nutrition, and health sciences due to the complexity of human performance [1]. China's unique blend of lengthy athletic past and powerful state-sponsored sports programs provides a fascinating case study. Athletes in China benefit from large support networks, structured coaching, and strenuous training regimens, making it a perfect setting to examine the influence of these factors on performance [2]. Often hailed as the cornerstone of sports success, coaching plays a pivotal role in China's sports landscape. The country has made significant investments in sports programs, underscoring the importance of coaches. Chinese coaches

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are renowned for their strategic acumen, technical skill, and ability to instill discipline and tenacity [3]. Coaching, in its broadest sense, encompasses mentorship, psychological support, and creating a development-friendly environment, in addition to teaching strategies and tactics. Effective coaching involves a deep understanding of each athlete's strengths and weaknesses to maximize potential and minimize injury risk. The intricate and ever-changing relationship between athletes and coaches significantly impacts the final outcome. The importance of an athlete's mental, emotional, and physical wellness to their performance on the field is increasingly recognized [4].

The intensive training and high-pressure situations in competitive sports can potentially impact athletes' mental and physical health. In China, where athletes commence training at an early age, health is a paramount concern. For sustained optimal performance, athletes must be physically, intellectually, and emotionally healthy. They require a comprehensive support system encompassing social, emotional, medical, and psychological assistance [5]. Training intensity also affects athletes' output. The Chinese sports system improves athletes' physical and mental with proper training. Balancing exercise and rest are essential for optimal performance and injury prevention. Monitor and adjust training intensity based on health and performance to determine the best for each sport and player. Peak athletic performance requires proper nutrition. The need for tailored nutrition programs to meet sports-specific issues is growing in China, where traditional dietary patterns combine with modern nutritional science [6]. Balanced diets help people recover quicker from rigorous activity and stay healthy. Getting adequate vitamins, minerals, and macronutrients may increase performance. Helping athletes create food programs that meet their metabolic needs and training goals is crucial [7].

Many interrelated factors affect athletic performance. Performance is affected by coaching, athlete health, training intensity, diet, and self-efficacy. Coaching enhances skill learning and mental fortitude by offering psychological support, technical teaching, and strategy development. Physical, mental, and emotional health helps athletes perform effectively and avoid injury. Overtraining may be avoided by adequately controlling training intensity, including session frequency and volume. This is essential for building physical endurance. Nutrition provides energy and nutrients for muscle growth and recuperation, improving health and athletic performance. Self-efficacy boosts motivation and performance by increasing self-confidence and faith. The main factors affecting performance in the Chinese sports environment are listed in Table 1.

The numerous elements affecting athletic performance interact via self-efficacy, a significant psychological aspect. Self-efficacy improves drive, tenacity, and resilience, helping athletes achieve their goals [13]. Understanding the origins and functioning of self-efficacy is vital, given China's collectivism, stubbornness, and respect for authority. There is an interconnected link between coaching quality, athlete health, training intensity, and nutrition that impacts athletic performance. Table 2 provides a detailed analysis of how coaching strategies affect performance measures.

Combining these elements to improve sports performance shows China's dynamic approach to sports. Chinese sports emphasize comprehensive development, which aligns with current ideas of athlete success. This comprises lifestyle management, mental conditioning, and physical training [16]. The current study examines the roles of coaching, athlete well-being, training intensity, and nutrition, with self-efficacy serving as a mediating factor. The results of this study may influence sporting practices in China and internationally. The study investigated the dynamic factors affecting Chinese athletes' athletic performance by addressing the following research questions. First, ***how do coaching quality and athlete well-being, when moderated by cultural values, affect the sports performance of Chinese athletes?*** In China's culturally unique and highly structured sports landscape, athletes' satisfaction and coaches' quality are crucial [17]. This investigation examines the relationship between athlete well-being (physical, mental, and emotional) and competent coaching (technical education, strategy creation, and psychological support). Cultural factors like tenacity, group cohesiveness, and authority may accentuate or change the coaching performance link [18]. Understanding these factors may enhance Chinese coaching and athlete care. Second, ***does self-efficacy mediate the relationship between training intensity, nutrition, and sports performance?*** The foundation of athlete performance is training intensity and nutrition. This study investigates whether self-efficacy mediates the relationship between proper food, hard training, and sports performance. High self-efficacy athletes are more likely to follow strict training regimens and eat well, improving performance [19]. It is crucial for establishing effective training regimens that balance intensity and recovery for athletes, who commonly play demanding sports [20]. Proper food improves recuperation and health, while intense exercise builds physical [21]. These research issues led to the following study objectives:

Table 1
Key factors influencing sports performance and their impact.

Factors	Description	Impact on Performance
Coaching	Involves technical training, strategy development, psychological support, and mentoring.	Enhances skill acquisition, strategic thinking, mental toughness, and motivation [8].
Athlete Well-being	Encompasses physical health, mental health, and emotional stability.	Ensures consistent performance, reduces injury risk, enhances recovery, and sustains motivation [9].
Training Intensity	Refers to the level and frequency of physical training and exercises.	Builds strength, endurance, and skill; overtraining can lead to fatigue and injuries [10].
Nutrition	Involves balanced intake of macronutrients and micronutrients tailored to individual and sport-specific needs.	Supports energy levels, muscle growth, recovery, and overall health [11].
Self-efficacy	The belief in one's ability to succeed in specific situations or accomplish a task.	Increases motivation, confidence, and resilience, directly influencing performance outcomes [12].

Source: Author's compiled.

Table 2
Relationship between coaching strategies and athlete performance metrics.

Coaching Strategy	Description	Impact on Performance
Technical Training	Improving specific skills and techniques.	Skill proficiency, accuracy, efficiency.
Psychological Support	Mental conditioning, stress management, motivation.	Mental resilience, focus, competitive mindset.
Strategic Development	Game plans, tactics, situational responses.	Tactical execution, adaptability, decision-making.
Personalized Feedback	Tailored feedback based on individual performance.	Continuous improvement, motivation, confidence.
Mentoring and Support	Building supportive coach-athlete relationships.	Overall well-being, self-efficacy, and long-term development.

Source: Author's extracted from the scholarly work of Blume et al. [14] and Horvath et al. [15].

I. To investigate the impact of coaching quality and athlete well-being on sports performance, focusing on the moderating role of cultural values.
II. To assess the effect of training intensity and nutrition on sports performance when incorporating self-efficacy as a mediating factor.

The study is structured as follows: The introduction is presented in section 1. The literature review is in section 2. The methodology is discussed in section 3. The results are discussed in section 4. The conclusion is in section 5.

2. Literature review

Multiple factors impact athlete effectiveness. Research has long wondered how athletes succeed, though recent findings suggest a multidimensional approach is needed to grasp performance's intricacies [22–24]. Coates et al. [25] outline the factors that affect athletic performance, emphasizing coaching and training intensity. As the guiding force, coaches motivate and assist athletes, making them crucial and indispensable to sports achievement [26]. A coaching style that respects athletes' autonomy and self-regulation may enhance performance and make the coaching experience more pleasurable and successful [27]. Collins et al. [28] discovered that this approach may boost athletes' motivation, confidence, and performance. Additional benefits include coaches prioritizing their players' mental and physical well-being, thereby preventing burnout and injuries [29].

Athletic performance also depends on athlete well-being. Physically and mentally fit, athletes perform better [30]. Sleep, recovery, and nutrition may improve athletes' performance [31], while anxiety and sadness must also be treated [32]. Athletes' well-being performance is also linked to a decisive factor-self-efficacy [33]. Lebria et al. [34] found that athletes who believe in themselves and have unwavering self-efficacy are likelier to make healthy decisions, persevere, and perform better. Training intensity affects athletes' physical and mental development, making it crucial to sports performance [35]. Lock et al. [36] reported that high-intensity training improved fitness and performance. However, Rodrigues et al. [37] found that it increased overreaching and burnout. Poorly handled high-intensity training may have the opposite impact on an athlete's confidence and motivation [38]. Peak performance also depends on how athletes nourish their bodies and minds [39]. Research suggests carbs, protein, and water may boost athlete performance [40]. However, athletes have diverse dietary needs and preferences. Therefore, nutrition regimes must be customized. More importantly, diet may affect athletes' self-perceptions of their competitive ability [41]. Nutrition, training intensity, player well-being, and coaching affect sports performance. A multidimensional strategy that integrates these factors and acknowledges self-efficacy may help athletes understand and optimize their performance. Table 3 shows the literature support of the key findings of the literature review.

Despite the wealth of research on athletic performance, there still need to be considerable information gaps. First, there needs to be more evidence on how coaching quality and athletes' well-being affect performance. Although some research has shown how nutrition and training intensity or coaching and player well-being interact, the whole picture of how different aspects impact sports performance still needs to be discovered [54,55]. Second, earlier studies primarily ignore demographic groupings and varied athletic environments, focusing on top athletes or specialized sports disciplines. This myopic approach overlooks the complex dynamics of athletic

Table 3
Summary of literature review.

Factors	Key Findings	Literature Support
Coaching Quality	High-quality coaching improves athlete performance, well-being, and self-efficacy.	[42]
	Effective coaching includes technical instruction, psychological support, and mentorship.	[43]
Athlete Well-being	Physical, mental, and emotional health are critical for sustained performance.	[44]
	Comprehensive support systems, including medical and psychological care, are essential.	[45]
Training Intensity	Optimal training balances intensity with adequate recovery to prevent overtraining.	[46]
	High-intensity training improves performance but requires careful management of athlete load.	[47]
Nutrition	Tailored nutrition plans enhance performance by meeting specific energy and recovery needs.	[48]
	Proper nutrition supports training intensity and overall health.	[49]
Cultural Values	Collectivism and respect for authority influence the effectiveness of coaching in Chinese athletes.	[50]
	Cultural values shape athlete behavior and response to training and coaching.	[51]
Self-efficacy	Higher self-efficacy leads to greater motivation, persistence, and performance.	[52]
	Influenced by coaching quality, athlete well-being, and training experiences.	[53]

Source: Author's compiled.

performance and cannot be extended to other populations or sports [56,57]. Research must involve recreational and underprivileged athletes to better understand performance determinants. Cultural intricacies affecting sports performance have yet to be extensively examined, although cultural values affect coaching dynamics and player behavior [58]. One must understand how cultural effects intersect with other performance variables to design culturally sensitive coaching and support systems that connect with different athlete groups. Many studies have identified athletic performance-boosting factors, but few have examined their interactions. Coaching quality, athlete well-being, training intensity, nutrition, cultural values, and self-efficacy affect performance, but their complex interactions must be recognized. The present study aims to address these information gaps and considerably advance sports performance research. This research combines coaching quality, athletes' well-being, training intensity, nutrition, cultural values, and self-efficacy to address a knowledge gap on what affects sports performance. The study's second goal is to enhance cross-cultural understanding in sports science by studying Chinese sportsmen. This will expose cultural nuances of performance dynamics. To ensure the validity and reliability of our findings, the study uses quantitative surveys to capture statistical relationships and explore the complex qualitative components of sports performance. Based on the stated discussion, the study has the following research hypotheses, i.e.,

H1. Improved coaching quality will positively affect athletes' well-being, workout power, and self-efficacy among Chinese athletes.

H2. Cultural values will moderate coaching quality and sports performance among Chinese athletes.

H3. The combined effect of the intensity of training and individualized nutrition programs will be able to predict the results of sports performance among Chinese athletes accurately.

The study's theoretical framework, shown in Fig. 1, provides a thorough model for understanding athletic performance's multiple components. According to Bandura's Social Cognitive Theory, self-efficacy facilitates the link between numerous factors and athletic performance [59]. This approach emphasizes observational learning, imitation, and modeling in behavior and self-efficacy building. This study contributes to Bandura's theory by combining it into a multi-faceted method that considers more athletic performance factors. The study tests the idea that self-efficacy interacts with coaching quality, athlete well-being, training intensity, and nutrition, in contrast to Bandura's theory, which focuses on cognitive processes and social implications. Cultural values are used as a moderating variable to examine how cultural factors affect the link between self-efficacy and athletic performance. This integration expands Bandura's theory to understand sports performance's ever-changing mental, emotional, and environmental interactions better. One psychological process linking high-quality coaching, healthy athletes and intense training to enhanced performance is self-efficacy or belief in one's capacity to achieve goals [60]. High-quality coaching, including mentorship, technical instruction, and psychological support, boosts athlete self-efficacy [61]. According to the H1, athletes who believe their instructors support them are more likely to improve their mental and physical health, exercise hard, and gain confidence. The paradigm also accounts for cultural characteristics, such as collectivism and authority, which are deeply established in Chinese sports culture. These cultural characteristics boost the performance-boosting advantages of great coaching. Due to collectivist countries' emphasis on teamwork and performance, athletes are likelier to follow their coaches' suggestions [62]. Cultural values affect how athletes respond to training and performance expectations and how coaches engage with them, supporting H2. Nutritional methods limit the performance effects of training intensity, another crucial paradigm component. The combination of personalized diets and high-intensity exercise is thought to maximize performance [63]. Intensely trained athletes require a specialized diet to meet their energy demands, hasten recovery, and prevent injuries [64]. Since this connection between training intensity and nutrition emphasizes both, a complete sports preparation approach seamlessly integrates nutritional therapies and physical conditioning is essential, supporting H3.

Along with these factors, athletes' well-being is crucial to performance. To perform well, one needs a dynamic support system that addresses mental, emotional, and physical wellness. The athlete wellness program includes mental and physical health support, stress management, and injury prevention [65]. Due to the significant association between well-being and self-efficacy, healthy, mentally resilient athletes are likelier to believe in their abilities and work hard to meet performance goals. This theoretical framework integrates self-efficacy, cultural values, exercise intensity, nutrition, and coaching quality. The study expects to better understand these

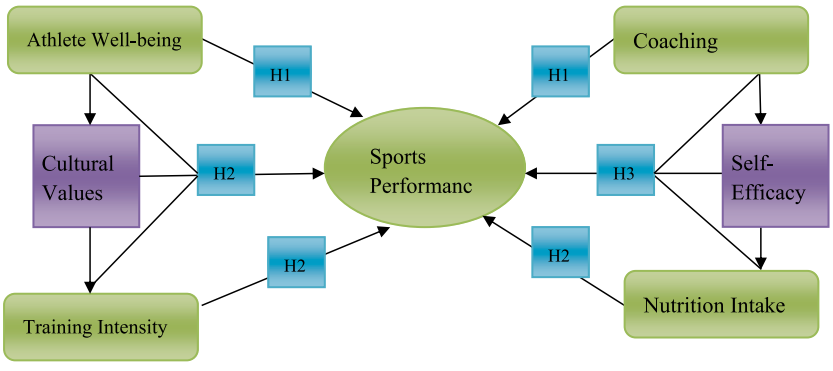

Fig. 1. Conceptual framework.
(Source: Author's work)

interrelated features in the context of Chinese athletes' culture. This comprehensive approach shows how numerous variables affect athletic performance and helps create culturally relevant training, food, and coaching programs.

3. Methodology

The study collected data from professional and amateur levels across all sports to provide a thorough and representative sample of Chinese athletes. Due to China's diverse athletic landscape, athletes from various regions, disciplines, and levels were included to complete the sports demographics picture. Athletes selected from remote areas, metropolitan centers, and rural areas were surveyed for this purpose. Due to its vast territory and diverse climates, cultures, and economies, regional variety is crucial to China's athletic development, training environments, and resource availability. The selected athletes competed in soccer, basketball, track and field, gymnastics, and martial arts. This diversity was essential in showcasing China's athletic programs due to their range of sports and mental and physical demands. The population included about 1300 athletes, providing a concentrated sample size. Eight hundred eighty athletes were stratified and randomly determined to participate in the study. It helps to eliminate selection bias and make findings more generalizable. Age, gender, sport, and competition level (professional vs. amateur) were considered during stratification. This ensured that the sample athletes were typical of the entire, enabling more reliable group comparisons. A systematic survey was presented to selected athletes to collect data. Several aspects were addressed while creating the survey to capture thorough data on coaching quality, exercise intensity, and food preferences. These areas illuminate athlete development and performance, making them essential to the study. The survey's quantitative and qualitative components included closed- and open-ended questions to examine athletes' experiences and perspectives. The sample responded 67.69 %, which is above average for this kind of study. This involvement illustrates the participants' engagement in the study and how relevant the questions were to their athletic experiences. A reasonable response rate shows that the sample represents the Chinese athletic community, boosting data validity and reliability. The survey was completed by a large number of the sample's athletes. Therefore, the results indicate the situation inside China's sports federation. The study employed many methods to ensure data accuracy—a preliminary round of testing with a selection of athletes clarified any confusion. Based on pre-test feedback, the survey was refined and updated. Data collection considered athletes' training and performance schedules, reducing survey fatigue and allowing for more informative replies.

Table 4 shows the study's sample composition and the factors affecting Chinese sports performance. Cities in each section depict athletes' residences and training sites. Players range from highly competitive national and international athletes to casual club players and spectators. The table shows the sample's wide range of sports, demonstrating China's athletic diversity. Table tennis, martial arts, basketball, and cycling are examples. Stratified random sampling ensures that every demographic grouping is represented. This approach randomly selects samples from each population stratum, determined by geography, participation, and other demographics. This strategy lowers sample bias and makes the research applicable to all Chinese athletes.

Compare average performance scores across locations and participation levels to understand how these factors affect Chinese sports performance. The average performance ratings of top athletes are rising everywhere, while East China's best athletes stand out at 85.3. These athletes may have access to top coaches, cutting-edge training facilities, and intensive diets. Recreational athletes, particularly in Northeast and South-Central China, have lower average performance due to a lack of resources that need to be improved. University and club-level participants have intermediate performance scores compared to top levels due to planned but less intense programs. This variability emphasizes the need for athlete-specific coaching, training intensity, and nutrition according to engagement and

Table 4
Sample of the study and average performance score.

Region/Province	City	Level of Participation	Types of Sport	Sample Participants	Average Performance Score
East China	Shanghai	Elite	Gymnastics, Swimming, Table Tennis	120	85.3
	Nanjing	Collegiate/ University	Basketball, Track and Field, Volleyball	80	78.9
	Hangzhou	Club level	Badminton, Soccer, Tennis	60	72.5
South Central China	Guangzhou	Recreational	Cycling, Hiking, Running	100	83.1
	Shenzhen	Elite	Boxing, Taekwondo, Weightlifting	80	68.4
	Changsha	Recreational	Yoga, Pilates, Swimming	70	67.8
North China	Beijing	Collegiate/ University	Basketball, Soccer, Track and Field	60	76.4
	Tianjin	Elite	Fencing, Archery, Judo	50	80.2
	Shijiazhuang	Club level	Rugby, Cricket, Squash	30	74.0
Northeast China	Harbin	Recreational	Ice Skating, Skiing, Snowboarding	40	70.6
	Shenyang	Elite	Wrestling, Ice Hockey, Speed Skating	30	81.7
Southwest China	Chengdu	Club level	Martial Arts, Climbing, Ultimate Frisbee	50	75.3
	Chongqing	Recreational	Tai Chi, Dragon Boat Racing, Trail Running	40	69.2
Northwest China	Xi'an	Collegiate/ University	Volleyball, Basketball, Rugby	50	77.1
	Lanzhou	Elite	Mountaineering, Cross-Country Skiing, Orienteering	20	84.5
Total Sample				**880**	

Source: Author's Survey.

competition location. These average performance scores confirm the study's findings that local variables and participation levels affect sports performance. Therefore, athlete development strategies should include these factors. Table 5 shows the Two-Way ANOVA analysis that reveals key athletic performance factors.

The statistically significant main impact shows that athletes' home areas affect their performance evaluations. Climate, training facilities, and regional sports culture might affect performance. Second, involvement level affects sports performance; elite athletes generally outperform club or leisure players. Top athletes have stronger coaching, resources, and support networks. The region's influence on athletic performance varies by participation level and geography, as interaction has a considerable effect. Some places have better facilities and training programs for elite athletes than recreational athletes. Table 6 shows the regression analysis across different athlete groups for ready reference.

The evidence demonstrates that gender and athlete participation levels affect athletic performance differently. High-level male professional athletes earned an average performance score of 85.4, with β values of 0.72 ($p = 0.002$) for coaching quality, 0.65 ($p = 0.005$) for training intensity, 0.58 ($p = 0.007$) for nutrition intake, and 0.67 ($p = 0.003$) for self-efficacy. These findings suggest that self-efficacy and coaching quality are critical to top-tier male athletes' success. Elite female professional athletes had an average performance score of 83.7, with lower β coefficients for coaching quality, training intensity, nutrition, and self-efficacy. Even though the coefficients are lower than men's, each component is equally relevant for elites of both sexes. Amateur male athletes at the collegiate/university level had an average performance score of 78.2, with β values of 0.54 for coaching quality ($p = 0.015$), 0.50 for training intensity ($p = 0.020$), 0.47 for nutrition ($p = 0.025$), and 0.52 for self-efficacy ($p = 0.018$). These attributes have a minor but significant effect on sports performance, demonstrating that systematic training and coaching are still crucial to collegiate success. Collegiate-level amateur female athletes had an average performance score of 76.7, with lower β values for coaching quality, training intensity, nutrition, and self-efficacy. Female athletes may have lower β values than male athletes owing to training techniques, resource constraints, or other factors affecting their performance. The average performance score for recreational male amateur athletes was 72.5, with β values of 0.45 for coaching quality ($p = 0.030$), 0.42 for training intensity ($p = 0.035$), 0.40 for nutrition ($p = 0.040$), and 0.46 for self-efficacy ($p = 0.032$ The factors are still relevant, but they have less impact when involvement is higher. Amateur female leisure athletes had the lowest β values for coaching quality, training intensity, nutrition, and self-efficacy. The average performance score was 71.1. As seen by this reduction, personal motivation or informal coaching may substantially impact the recreational level more, reducing structured coaching and training.

Table 7 shows the list of the variables, including explanatory variables, moderator and mediator that affect the outcome variable. Further, the scale of the items and sample questions are mentioned, supported with the earlier literature, for ready reference.

The research's data is analyzed thoroughly to ensure the model's validity and reliability. Various analytical methods are used to get insights from the data. The model's validity is assessed by content and construct validity. A careful review of relevant research and expert conversations ensures that questionnaire items sufficiently cover essential subjects, ensuring content validity. The study evaluates construct validity using Confirmatory Factor Analysis (CFA) to see whether the measured variables match the theoretical components. Internal consistency indicators like Cronbach's Alpha assess the model's reliability by comparing responses across scales. The structural model's latent variables' composite reliability is also assessed. The study further used factor analysis. The study first utilizes exploratory factor analysis (EFA) to understand variable interdependencies further and discover the factor structure. Next, validate the measurement model and assess the expected component structure using confirmatory component analysis (CFA). This ensures model accuracy and resilience. The study utilizes Structural Equation Modeling (SEM) to examine the links between coaching quality, athlete well-being, training intensity, nutrition, self-efficacy, cultural values, and sports performance. SEM allows the simultaneous analysis of complex models and their direct and indirect effects. Its versatility allows it to explore several interactions in one framework, explaining how diverse factors impact athletic performance. SEM is helpful in this study since it can analyze theoretical connections and manage complex models. Table 3 shows SEM fit indices to evaluate the model's ability to describe variable relationships. The first fit metric, Chi-square (χ^2), measures the difference between expected and actual covariance matrices. Although the Chi-square test is sample size dependent, a smaller result indicates a better match. Further, the Chi-square/df ratio to account for this; values below 3.00 indicate a good match. RMSEA values below 0.08 suggest that the model's predictions are close to the observed data. The Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) evaluate fit enhancement by comparing the proposed model to a control model. Suitable matches have CFI and TLI values > 0.90. The Standardized Root Mean Square Residual (SRMR) should be below 0.08 for a satisfactory fit to demonstrate a strong correlation between observed and anticipated values. Table 8 shows the SEM fit indices for ready reference.

Interpreting these fit indicators may help the SEM model explain the relationships between the variables. Understanding fit indices helps establish the model's validity and reliability, boosting the study's credibility and robustness.

Table 5
Two-way ANOVA results by region and participation level on sports performance.

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Value	P-Value
Region	320.5	5	64.1	7.45	0.0004
Level of Participation	400.3	3	133.43	15.52	0.0001
Interaction (Region x Level)	150.2	15	10.01	2.75	0.031
Error	900	856	1.05		
Total	1770	879			

Source: Author's estimate.

Table 6
Regression analysis across different athlete groups.

Group	Gender	Level of Participation	Coaching Quality (β)	Training Intensity (β)	Nutrition (β)	Self-efficacy (β)	Average Performance Score
Professional	Male	Elite	0.72 (0.002)	0.65 (0.005)	0.58 (0.007)	0.67 (0.003)	85.4
Professional	Female	Elite	0.68 (0.003)	0.6 (0.008)	0.55 (0.010)	0.64 (0.004)	83.7
Amateur	Male	Collegiate/ University	0.54 (0.015)	0.5 (0.020)	0.47 (0.025)	0.52 (0.018)	78.2
Amateur	Female	Collegiate/ University	0.5 (0.018)	0.48 (0.022)	0.44 (0.028)	0.5 (0.020)	76.9
Amateur	Male	Recreational	0.45 (0.030)	0.42 (0.035)	0.4 (0.040)	0.46 (0.032)	72.5
Amateur	Female	Recreational	0.42 (0.034)	0.4 (0.038)	0.38 (0.045)	0.44 (0.036)	71.1

Source: Author's estimate.

Table 7
Variables, scale, and sample items.

Variables	Scale	Sample Items	Literature Support
Coaching Quality	Coaching Efficacy Scale (CES)	My coach provides effective feedback to improve my performance.	[66]
Athlete Well-being	Radloff's Psychological Wellbeing Scale	I feel physically healthy and fit.	[67]
Training Intensity	Self-Regulate Resistance Training Intensity Scale.	My training sessions are appropriately challenging	[68]
Nutrition	Sports Nutrition Questionnaire	My diet is well-balanced and meets my nutritional needs.	[69]
Self-efficacy	Physical Self-Efficacy Scale	I am confident in my ability to succeed in my sport.	[70]
Sports Performance	Self-Control Scale (SCS)	I consistently perform at my best during competitions.	[71]

Source: Authors compiled.

Table 8
Structural equation modeling (SEM) fit indices.

Fit Index	Recommended Value	Model Value	Description
Chi-square (χ^2)	Low values are better	158.45	Measures the discrepancy between the observed and expected covariance matrices.
Chi-square/df	<3.00	1.98	Adjusts Chi-square by degrees of freedom, indicating a good fit if < 3.00.
RMSEA	<0.08	0.045	Root Mean Square Error of Approximation, indicating a good fit if < 0.08.
CFI	>0.90	0.95	Comparative Fit Index, indicating a good fit if > 0.90.
TLI	>0.90	0.94	Tucker-Lewis Index, indicating a good fit if > 0.90.
SRMR	<0.08	0.035	Standardized Root Mean Square Residual, indicating a good fit if < 0.08.

Source: Authors extracted from the scholarly work of Ding et al. [72] and Sive et al. [73].

4. Results and discussion

Table 9 summarizes the demographics of 880 study participants. The biggest group of responders (36.4 %) is between 26 and 35, followed by 36 and 46 (22.7 %). Half the responses are 19–25, while roughly 20 % are 47+. The sample is 68.2 % male and 29.5 % female, favoring male respondents. Athletic activity is most potent at the club (34.1 %), collegiate/university (31.8 %), and recreational (20.5 %) levels. Few (13.6 %) participants are elite.

According to the poll, 31.8 % of respondents play endurance sports, 28.4 % team sports, 22.7 % individual sports, and 17.0 % combat sports. Across sports experience groups, years of experience are distributed similarly. The largest group of responders had 4–6 years of experience (27.3 %), followed by 7–10 years (22.7 %) and more than 10 years (22.7 %). Respondents had bachelor's degrees (39.8 %), master's degrees (28.4 %), high school certificates or equivalents (11.4 %), or no formal education (3.4 %). Respondents were from diverse socioeconomic backgrounds. The biggest income group (34.1 %) is ¥100,000–999,999, followed by ¥200,000-¥299,999 (22.7 %) and ¥50,000-¥99,999 (11.4 %). Finally, responders are from all around China, although the northeast (22.7 %), center (17.0 %), and west (18.2 %) make up the majority. Table 10 shows descriptive statistics, Cronbach's alpha coefficients, and KMO values for research variables.

Respondents rate coaching effectiveness extremely highly (4.23 mean score). The low standard deviation of 0.65 shows that responses are closely concentrated around the mean. Internal consistency reliability is high, with a Cronbach's alpha of 0.86, indicating a substantial correlation between coaching quality components. The KMO score of 0.83 suggests that the dataset's items are sufficiently related to merit factor analysis and high statistical assessment. Athletes often evaluate their health positively. The internal consistency reliability is sufficient since the standard deviation is 0.72, higher than the coaching quality, while Cronbach's alpha coefficient is 0.78, which is still excellent. The KMO score of 0.75 indicates that the dataset is adequate for factor analysis, albeit below coaching quality. Training Intensity, averaging 4.56, indicates high perceived training program intensity. The low standard deviation of 0.60 indicates that respondents agree. The measuring scale's strong Cronbach's alpha of 0.92 indicates internal consistency and robustness. The KMO score of 0.88 confirms the dataset's factor analysis eligibility. A mean nutrition score of 3.75 for athletes indicates a reasonably

Table 9
Demographic survey of respondents (N = 880).

Demographic Characteristic	Frequency	Percentage (%)
Age		
−19-25	220	25.0
−26-35	320	36.4
−36-46	200	22.7
−47 and above	140	15.9
Gender		
- Male	600	68.2
- Female	260	29.5
Level of Participation		
- Elite (National/International level)	120	13.6
- Collegiate/University level	280	31.8
- Club level	300	34.1
- Recreational	180	20.5
Type of Sport		
- Individual sport (e.g., athletics, swimming, tennis)	200	22.7
- Team sport (e.g., football, basketball, volleyball)	250	28.4
- Combat sport (e.g., martial arts, boxing, wrestling)	150	17.0
- Endurance sport (e.g., marathon running, cycling)	280	31.8
Years of Experience in Sports		
- Less than 1 year	60	6.8
- 1–3 years	180	20.5
- 4–6 years	240	27.3
- 7–10 years	200	22.7
- More than 10 years	200	22.7
Education Level		
- Less than high school	30	3.4
- High school diploma or equivalent	100	11.4
- Bachelor's degree	350	39.8
- Master's degree	250	28.4
Annual Household Income		
- Less than ¥50,000	50	5.7
- ¥50,000 - ¥99,999	100	11.4
- ¥100,000 - ¥199,999	300	34.1
- ¥200,000 - ¥299,999	200	22.7
- ¥300,000 and above	130	14.8
Region of Residence in China		
- East China	200	22.7
- South Central China	150	17.0
- North China	100	11.4
- Northeast China	120	13.6
- Southwest China	150	17.0
- Northwest China	160	18.2

Source: Author's survey.

Table 10
Descriptive statistics, Cronbach's alpha, and KMO value.

Variables	Mean	Standard Deviation	Cronbach's Alpha	KMO Value
Coaching Quality	4.23	0.65	0.86	0.83
Athlete Well-being	3.89	0.72	0.78	0.75
Training Intensity	4.56	0.60	0.92	0.88
Nutrition	3.75	0.68	0.80	0.77
Self-efficacy	4.45	0.58	0.88	0.85
Cultural Values	4.47	0.53	0.89	0.86
Sports Performance	4.72	0.20	–	–

Source: Author's estimate.

favorable assessment of food habits. The standard deviation of 0.68 reveals significant response variability, while Cronbach's alpha of 0.80 indicates good internal consistency. The KMO score of 0.77 indicates that the dataset is adequate for factor analysis, ensuring a complete study of dietary behavior variables. The average self-efficacy score and cultural values of 4.45 and 4.47 shows that athletes motivate and believe in themselves and their talents. A low standard deviation of 0.58 and 0.53 indicates good respondent agreement. Cronbach's alpha of 0.88 and 0.89 confirms the scale's internal consistency. With a KMO value of 0.85 and 0.86, the dataset for both the variables are ideal for factor analysis, ensuring a complete study of self-efficacy variables. Table 11 summarizes the factor analysis results by examining factor loadings and component variance.

Factor 1 dominates with 23.5 % of sample variance and 0.82 factor loading. This factor, encompassing coaching quality, athlete well-being, and training intensity, likely impacts sports performance. Factor 2 explains 18.9 % of the variance and has a 0.76 factor loading. This component represents another vital aspect of sports performance: nutrition, confidence, and training methods. Factor 3 accounts for 15.7 % of the variance and has a moderate factor loading of 0.68. Factors 4 and 5 have factor loadings of 0.59 and 0.53, which help us understand athletic performance. These factors explain 10.1 % and 12.31 % of the variance, suggesting they affect athletic competition performance. These components account for a large portion of the dataset's volatility, showing their importance for predicting athletic success.

Table 12 shows the SEM findings for ready reference. A significant positive correlation exists between coaching quality and sports performance ($\beta = 0.62$, $p < 0.001$), highlighting the influential role coaching plays in athlete success. Social Cognitive Theory links high-quality coaching and athletic achievement, which holds that their environment highly impacts people's behaviors and outcomes. Social persuasions, mastery experiences, and vicarious experiences influence self-efficacy [73]. Good coaching may boost athletes' self-efficacy by providing constructive feedback, setting achievable goals, and creating a supportive team environment. Prior studies support this conclusion [74,75]. In a comprehensive review, Sandbakk et al. [76] found that high-quality coaching improves athlete performance. This is true across many sports and competitive levels. Good coaching improves athletes' technical skills, tactical awareness, mental toughness, and performance. These findings emphasize the need for management to sponsor coach education, training, and development initiatives to improve coaching. Sports organizations and governing bodies should employ and retain coaches with the relevant experience, skills, and understanding to enhance athlete development and performance. Continuous assistance, feedback, and professional development for coaches may improve coaching quality and athlete performance.

A significant positive correlation between athlete well-being and sports performance ($\beta = 0.48$, $p < 0.001$) is evident. This underscores the complexity of athlete development, making focusing on athletes' physical, mental, and emotional health essential to enhance performance. According to Bandura's Social Cognitive Theory, internal, environmental, and behavioral factors impact people's behaviors and outcomes, and athletes' happiness and field performance are linked. An athlete's belief system, intentions, and behaviors may be influenced by their entire health, including mental and emotional resilience and physical health [77]. Thus, investing in athlete well-being may have far-reaching effects on performance. This finding is supported by Fogaca (2021), who carefully evaluated athlete well-being and performance literature. In their athlete well-being study, physical health, mental health, social support, and performance results across all levels of competition and sports were substantially correlated [78]. Well-being helps athletes perform better in technical skills, decision-making, and competition.

The favorable association between training intensity and sports performance ($\beta = 0.55$, $p < 0.001$) highlights its significant role in players' competitive success. This result stresses the need for tight and regulated training regimens for athletes' performance. Challenging and gradual training programs elicit physiological adaptations and improve athletic performance [79]. Repetitive exercise stress improves the body's physiological capacity. Athletes may increase strength, stamina, speed, and skill development by progressively increasing training volume, intensity, and duration. Progressive overload is essential for optimizing training and sports performance [80]. Ju et al. [81] indicated that athletes who did high-intensity activities performed better. According to Karabıyık et al. [82], elite swimmers who underwent high-intensity interval training increased their swim times and stroke efficiency more than those who did moderate-intensity training.

Adequate nutrition is vital for athletes' physical performance, as seen by the significant positive correlation ($\beta = 0.42$, $p < 0.001$) between the two variables. The result emphasizes the need for personalized nutrition regimens that meet athletes' nutritional and training needs [83]. It is commonly recognized that nutrition affects athletic performance. Energy metabolism, muscle function, and recovery are affected by athletes' diets. Proper nutrition supports exercise, muscular growth and repair, hydration, and immune function. Sports nutrition research emphasizes nutritional optimization to optimize training adaptations and increase athletic performance, which supports this conclusion. Training intensity, duration, and sport affect athletes' diets [84]. Personalized nutrition regimens that address athletes' physiological and performance needs are essential for athletes to perform at their best. Many studies have demonstrated that glucose loading, protein supplementation, and hydration impact performance parameters, including strength, speed, endurance, and recovery [85,86].

The strong positive connection between self-efficacy and sports performance significantly impacts athletes' confidence in their ability to attain optimal performance results. The result states that skill beliefs strongly influence motivation, goal-setting, and resilience. Self-efficacy is confidence in one's ability to complete a task and achieve a goal. Believers in their skills are more inclined to push themselves, persevere, and achieve in sports. When athletes believe in themselves and their abilities, they practice and compete more motivated, focused, and persistently. Sports psychology research has linked self-confidence to field performance. Garcia [87]

Table 11
Factor analysis results.

Factors	Factor Loadings	Variance Explained (%)
Factor 1	0.82	23.5
Factor 2	0.76	18.9
Factor 3	0.68	15.7
Factor 4	0.59	12.3
Factor 5	0.53	10.1
Total		**80.5**

Source: Author's estimate.

Table 12
Structural equation modeling (SEM) results.

Path	Coefficient	Standard Error	t-value	p-value	95 % CI (Lower)	95 % CI (Upper)
Coaching Quality → Sports Performance	0.62	0.09	6.89	<0.001	0.45	0.79
Athlete Well-being → Sports Performance	0.48	0.07	6.87	<0.001	0.35	0.61
Training Intensity → Sports Performance	0.55	0.08	6.75	<0.001	0.39	0.71
Nutrition → Sports Performance	0.42	0.06	7.12	<0.001	0.32	0.54
Self-efficacy → Sports Performance	0.57	0.10	5.92	<0.001	0.39	0.75
Moderation (Cultural Values)	0.37	0.08	4.63	<0.001	0.28	0.46
Mediation (Self-efficacy)	0.51	0.10	5.17	<0.001	0.39	0.63

Source: Author's estimate.

found that college basketball players who believed in themselves shot better, defended better, and performed better.

The statistically significant moderation (cultural values) path coefficient shows that cultural values regulate the relationship between the factors and athletic performance. The research emphasizes the importance of cultural context while studying and optimizing athlete performance. Cultural values affect athletes' reactions to coaching, training, and performance expectations [88]. These principles may include collectivism, individuality, and authority. Coaching strategies that promote collaboration and cooperation may affect athletes from cultures that value individual achievement differently from those that value teamwork and collective accomplishment. Coaches who understand and accept athletes' cultural values and customs may enhance training settings, motivation, and performance [89].

Self-efficacy mediates the relationship between sports performance and coaching quality, athlete well-being, training intensity, and nutrition according to the statistically significant mediation (self-efficacy) path coefficient. This study reveals that these factors impact athletes' confidence and performance. Self-efficacy plays a significant role in a person's motivation, hard effort, and persistence to attain their goals. Confident athletes are more likely to persevere, accomplish their goals, and keep going [90]. Goal-setting, performance feedback, and mental skills training aim to boost athletes' self-efficacy. When coaches and practitioners recognize self-efficacy as a critical mechanism by which coaching, wellness, training, and nutrition affect performance, individualized therapies may improve athletes' psychological readiness and competitive performance [91].

The study shows the complex relationship between factors affecting athletic performance, focusing on cultural values as a moderator and self-efficacy as a mediator. Other research has demonstrated that nutrition, training intensity, athlete well-being, and coaching quality individually contribute to sports performance, while this study shows their synergistic effects [92,93]. Using the SEM approach, the study found that coaching quality was the most significant predictor of athlete performance, emphasizing the significance of effective coaching in enhancing outcomes. This finding fills a literature gap by assessing coaching quality in a culturally diverse sports group. Research indicates that self-efficacy significantly boosts the positive effects of coaching, health, training intensity, and nutrition on athletes' performance. The study also introduces cultural values as a moderating component, which has yet to be studied. This strategy provides a more comprehensive picture of how culture affects these essential elements and sports success. The findings suggest that athletes from various cultures may respond differently to coaching, training, and nutrition regimens, emphasizing the need for culturally conscious coaching.

5. Conclusions and policy recommendations

The study explores the complicated relationships between coaching quality, athletes' mental health, training intensity, food, self-confidence, and cultural values on Chinese athletes' performance. The Structural Equation Modeling (SEM) results underscore the pivotal roles of these variables, indicating their direct and mediated effects on athletes' performance outcomes. These findings emphasize the need for comprehensive athlete development programs with top-notch coaching, athlete-centric support services, and culturally sensitive techniques to enhance performance. To take advantage of these benefits, policymakers should invest more in coaching development programs that increase coaching quality and effectiveness. Sports organizations may maximize athletes' potential and performance by training, supporting, and resourcing their coaches. Sports managers should encourage such programs to provide athletes with specialized physical, mental, and emotional health care. Implementing broad support networks may help athletes build resilience, prevent burnout, and foster long-term success. Policymakers must also realize that cultural values affect athletes' emotions and performance. Cultural awareness training and welcoming places that respect athletes' diverse experiences and opinions may help players feel more connected to the team and its principles. Funding research and initiatives on cultural values and sports performance helps ensure that all athletes have equal opportunities and favorable outcomes. This will influence culturally sensitive coaching and training. While the study provides valuable insights, it is important to acknowledge its limitations. The study is cross-sectional, necessitating the use of longitudinal data to establish cause-and-effect relationships. To enhance the validity and dependability of future research, it is recommended to incorporate objective performance indicators and multi-method methodologies. Further, research should examine mediators and moderators of the complex relationships between coaching quality, athletes' well-being, training intensity, nutrition, self-efficacy, and cultural values. The long-term influence of these factors on athletic accomplishment may be better understood by using longitudinal studies that track athletes' development and performance. A comparative study in diverse cultures may explain whether these outcomes are universal or context-specific to help create internationally relevant, culturally sensitive athlete development tactics.

Ethics declaration

This study protocol received ethical approval from the Human Ethics Committee of the Institute for Social Science (HEC/ISS) following the Declaration of Helsinki under approval code 0520/ISSDKU/0221. Participant information was anonymized, and the Human Ethics Committee of the Institute for Social Science (HEC/ISS) waived the requirement for informed consent.

Data availability

Data for this study will be made available to the corresponding author upon request.

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CRediT authorship contribution statement

Panna Yang: Writing – original draft, Formal analysis, Conceptualization. **Ruilin Xu:** Supervision, Methodology, Data curation. **Yanyan Le:** Writing – review & editing, Software, Investigation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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