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Cognitive Survey of Strength and Conditioning Testing by high-level Strength and Conditioning Coaches in China

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Abstract: *This study explored the cognitive understanding of strength and conditioning (S&C) testing among high-level strength and conditioning coaches (S&CCs) in China. The paper-based and online survey was conducted on 30 S&Cs from various high-performance sports teams in China. Data analysis aimed to comprehend their cognitive understanding level of testing, sport-specific testing, and influencing factors in S&C testing. The findings revealed a consensus among S&CCs, both domestically and internationally, on specific S&C testing indicators. However, disparities were observed in their comprehension of S&C testing, influenced by factors such as educational background, interdisciplinary knowledge reservoirs, accreditation of S&C qualifications, and hands-on experience. Future research should encompass a broader range of sports to further validate these influencing factors.*

Keywords: *strength and conditioning training, coaches, cognitive survey, testing, high-performance sports team*

1. Introduction

Enhancing athlete performance is a primary objective in competitive sports, necessitating accurate assessments and targeted training interventions. S&CCs play a pivotal role in this process, employing a myriad of testing methods to evaluate athletes' performance [1].

Since the late 1990s in China, major domestic sports teams have become aware of their inadequacies in S&C training, particularly the Chinese national table tennis team, which took the lead in focusing on S&C training and introduced dedicated S&CCs [2]. With strong support from the General Administration of Sport of China, many scholars, experts, and coaches have gone to sports-developed countries such as the United States, Germany, Russia, the United Kingdom, and Australia to study and exchange ideas, introducing new concepts and testing methods of S&C. The introduction of these advanced theories and practices from abroad has injected new vitality into the development of modern S&C training and testing in China, gradually integrating it into the practice of preparing high-level athletes for the Olympics, and achieving significant results in major world events and the Olympics [3].

However, despite the many benefits of S&C testing, it also faces controversy and challenges in China. On October 26, 2019, Shanghai basketball player Zhaoxu Zhang was accidentally injured during the China Basketball Association (CBA) squat test, sparking controversy over S&C testing [4]. Subsequently, the General Administration of Sport of China issued the "Notice on Further Strengthening Basic S&C Training to Make Up for S&C Shortcomings" on February 27, 2020, emphasizing the selection criteria that "S&C test results are the entry ticket to the Tokyo Olympics." If athletes fail to pass the S&C test, they will be unable to participate in the Tokyo Olympics. Many outstanding and promising athletes lost their qualifications to participate in the Tokyo Olympics due to their failure to pass the S&C test, once again sparking controversy and discussion on S&C testing [5]. This indicates that as an effective means of assessing athletic performance, S&C testing still faces numerous issues and challenges in practical applications in China, warranting further research and exploration by S&CCs and researchers.

Existing literature underscores the importance of S&C testing in sports performance evaluation and athlete development [6]. However, there is currently a lack of comprehensive understanding regarding the cognitive understanding of S&C testing and its practical application among *high-performance sports* teams. Therefore, this study aimed to investigate the cognitive awareness of high-level S&CCs

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in China regarding S&C tests and to analyze the influencing factors affecting their cognition. Through survey research, the study intended to summarize the testing indicators highly correlated with various sports and their utilization. Additionally, a comparative analysis was conducted to explore differences in the cognitive levels of S&CCs between domestic and international contexts. Ultimately, based on the findings, corresponding strategic recommendations were proposed to facilitate the effective application and development of S&C testing in practical applications.

2. Method

2.1 Experimental Approach to the Problem

This study adopted a cross-sectional study method and collected data through questionnaire surveys.

2.2 Subjects

The targeted participants consisted of 30 *high-level* S&CCs in China, each possessing a minimum of one year of experience in training athletes for Olympic-level competitions. This cohort comprised 7 international S&CCs and 23 Chinese S&CCs. Approval for the study was obtained from the ethics committee of Shanghai University of Sport.

2.3 Survey

Based on previous research, S&C test indicators in this study were categorized into four dimensions: body morphology, physical function, physical fitness, and functional evaluation [7-15]. These dimensions were then further subdivided. Based on the selected indicators, a survey questionnaire was designed to assess the correlation between specific sports and the utilization rate of test indicators, with scores assigned as follows: Not relevant (1-2 points), Slightly relevant (3-4 points), Moderately important (5-6 points), Comparatively important (7-8 points), Very important (9-10 points), Utilization rate (1-10). This survey included various aspects such as participants' personal information like name, gender, and age, as well as their professional background such as the number of years spent in S&C coaching, relevant work experience, and educational qualifications. It also explored the scope of their responsibilities in sports projects, the challenges they faced while conducting tests, their self-assessment of coaching abilities, areas for personal improvement, and their understanding of the sports projects they were currently involved in. Additionally, it delved into their weekly workload, requirements for conducting S&C tests, and finally, solicited their recommendations or insights on the status quo of S&C training both nationally and internationally.

2.4 Data collection procedures

This study employed a self-designed survey questionnaire and utilized the Questionnaire Star platform for online distribution, as well as paper-based questionnaires. Prior to questionnaire development, validity testing was conducted by seeking input from three experts in the field of S&C, all of whom provided their endorsement. Preceding the formal distribution of the questionnaire, a pilot study involving 10 randomly selected S&CCs was conducted, followed by a second round of questionnaire distribution to the same group after a two-week interval from the initial distribution. Analysis of the results from both rounds of data collection yielded a Cronbach's alpha coefficient of 0.75, indicating a high level of internal consistency and alignment with the research objectives. The survey was disseminated using questionnaires available in both Chinese and English languages.

2.5 Statistical Analyses

All data obtained from paper-based questionnaires and WJX surveys were imported into a Microsoft Excel spreadsheet (Microsoft Corporation, Redmond, WA). Statistical analyses of all collected data were conducted using SPSS 26.0 software (IBM Corp., Armonk, NY, USA). Fixed-response questions were evaluated through frequency analysis [16].

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3. Results

3.1 Demographic Information

This study employed both paper-based and online questionnaires for data collection. A total of 30 questionnaires were distributed, yielding 30 valid responses. The study comprised 30 S&CCs (28 males, 2 females; mean age = 35.3 years, SD = 6.3 years, range: 25-54 years; mean experience as S&CCs = 11.5 years, SD = 5.5 years, range: 4-28 years). Among them, 24 were domestic coaches and 6 were international coaches. Regarding educational background, 8 coaches held bachelor's degrees, 16 held master's degrees, and 6 held doctoral degrees (Figure 1). S&CCs worked across 13 sports in total (Figure 2).

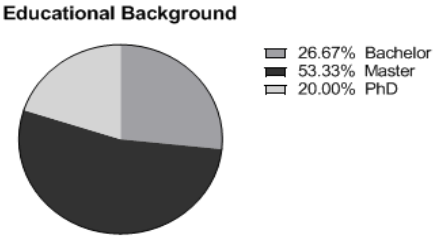

Figure 1: Educational Background (n=30).

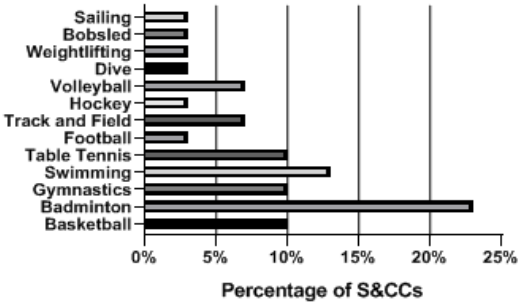

Figure 2: Sports S&CCs work in (n=30).

3.2 Application of Specialized Testing Indicators for Sports Performance

The questionnaire was unable to cover all detailed indicators related to S&C testing but rather preliminarily selected more comprehensive S&C testing indicators. In determining the preliminary selection of indicators in the questionnaire, two main principles were primarily considered: first, tests commonly used by sports teams were selected, combined with basic professional knowledge judgment to select testing indicators that had a certain impact on the sports; second, the significance of indicator testing for training mainly lay in monitoring indicators that could be changed through training. For example, for adult athletes who complete basic development, monitoring anthropometric indicators such as height and arm length is not significant, as these indicators are typically used for sports selection or basic information reference and do not change significantly with training. For sports involving two or more respondents, the mean and coefficient of variation (CV) were calculated using SPSS 26.0 based on the questionnaire survey results. The mean reflected the concentration of opinions of S&CCs on the indicators, with higher values indicating greater importance, requiring a mean not less than 7.5. The CV indicated the degree of agreement among S&CCs on a particular indicator, with smaller values indicating higher agreement, requiring a coefficient less than 20%.

3.2.1 Level 1 S&C Testing Indicators

Table 1 presented the survey analysis results of four level 1 indicators for 13 sports. In badminton, physical function was considered the most crucial indicator in S&C testing, followed by physical fitness, body morphology, and functional testing, with mean scores exceeding 7.5. Moreover, the level of coordination among fitness coaches was relatively high, with physical function exhibiting the highest level of convergence in perception, followed by functional testing and physical fitness, while convergence in perception regarding body morphology was relatively low. In swimming, physical

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fitness was considered the most important indicator in S&C testing, followed by physical function, body morphology, and functional evaluation, with mean scores exceeding 7.5, except for functional evaluation. The convergence in the perception of physical function was the highest, while the convergence in the perception of functional evaluation was the lowest. In table tennis, physical function was deemed the most important, followed by physical fitness, functional evaluation, and body morphology. Physical fitness exhibited the highest level of convergence, while the convergence of physical function was the lowest. In basketball, physical function was considered the most important, followed by physical fitness, functional evaluation, and body morphology. Physical function exhibited the highest level of convergence, followed by body morphology. In gymnastics, physical fitness was considered the most important, followed by physical function, body morphology, and functional evaluation. In track and field, physical function was considered the most important, followed by physical fitness, functional evaluation, and body morphology. The convergence in perception of physical function and physical fitness was the highest. In volleyball, the importance of physical fitness ranked highest, followed by physical function, body morphology, and functional evaluation. Other sports disciplines surveyed a S&C coach, although importance and convergence analyses were not conducted, they still held certain reference values.

Table 1: Survey results for level 1 S&C test indicators.

Badminton (n=7)				
	Body Morphology	*Physical Function*	*Physical Fitness*	*Functional evaluation*
Mean±SD	*8±1.4*	*8.7±0.9*	*8.6±1.5*	*7.7±1.2*
CV%	*17.5%*	*10%*	*17%*	*15.6%*
Swim (n=4)				
Mean±SD	*8±1.4*	*8.7±0.9*	*9±1.4*	*6.7±2.2*
CV%	*17.5%*	*10%*	*15.5%*	*32.8%*
Table Tennis (n=3)				
Mean±SD	*4±1*	*8.3±2.1*	*8±1*	*6.3±1.5*
CV%	*25%*	*25.30%*	*12.50%*	*23.80%*
Basketball (n=3)				
Mean±SD	*7.3±0.6*	*9.3±0.6*	*8.3±1.5*	*8.3±1.2*
CV%	*8%*	*6%*	*18%*	*14.40%*
Gymnastics (n=3)				
Mean±SD	*8±2*	*8.3±1.5*	*9±1*	*7.6±3.2*
CV%	*25%*	*18%*	*11.10%*	*42%*
Track and Field (n=2)				
Mean±SD	*7±2.8*	*9±0*	*8±0*	*7.5±0.7*
CV%	*40%*	*0*	*0*	*9%*
Volleyball (n=2)				
Mean±SD	*7.5±0.7*	*8.5±0.7*	*9.5±0.7*	*7±1.4*
CV%	*9%*	*8.20%*	*7.30%*	*20%*
Football (n=1)				
Mean	*8*	*7*	*9*	*7*
Hockey (n=1)				
Mean	*8*	*9*	*10*	*7*
Sailing (n=1)				
Mean	*8*	*10*	*10*	*6*
Dive (n=1)				
Mean	*9*	*7*	*9*	*8*
Weightlifting (n=1)				
Mean	*7*	*8*	*10*	*8*
Bobsled (n=1)				
Mean	*8*	*10*	*10*	*7*

3.2.2 Level 2 S&C Testing Indicators

Table 2 presented the survey results of level 2 indicators across 7 sports. The remaining four sports were not detailed in the table due to the limited survey response from only one S&CCs. Consistent trends were observed across all sports, indicating widespread acknowledgement among S&CCs for indicators with an average score exceeding 7.5 and a coefficient of variation below 20%.

Taking badminton as an example, we found that 26 indicators had an average score exceeding 7.5, suggesting a close association with badminton and a high level of correlation. Simultaneously, 24 indicators had a CV below 20%, indicating good consistency and stability. Encouragingly, 20 indicators simultaneously met both criteria, such as body fat rate (BFR), lean body mass (LBM), heart rate (HR), blood lactic acid (BLA), creatine kinase (CK), lung capacity (LC), lactate threshold (LT), VO2max, bench press (BP) 1 repetition maximum (1RM), grip 1RM, deadlift 1RM, back squat 1RM, standing long jump (SLJ), vertical jump (VJ), reactive strength index (RSI), pull up, sprint, 5-10-5 agility, functional movement screen (FMS), and Y-balance test (YBT). This indicated a consensus among S&CCs regarding the importance and reliability of these level 2 indicators in badminton.

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Similar situations were observed in other sports. For instance, in basketball, 23 indicators had an average score exceeding 7.5, indicating a high degree of association with basketball, while 33 indicators had a CV below 20%, indicating good consistency. Among them, 21 indicators simultaneously met both criteria, such as height&body mass, BFR, LBM, etc. These results reflect a consensus among S&CCs regarding these level 2 indicators and provide important references for the development of corresponding training plans and assessment criteria.

The commonly used S&C test indicators in these sports cover various key aspects, including speed, endurance, explosiveness, flexibility, and coordination. These indicators are widely applied in sports science research to assess athletes' overall fitness levels and their performance capabilities in specific sports. For example, in basketball, VJ height, lateral movement speed, and coordination are considered decisive factors. In swimming, endurance, speed, and underwater propulsion are important indicators for evaluating swimming performance. The use of these test indicators not only helps coaches and athletes understand their current fitness levels but also guides personalized training plans to improve athletes' overall competitive performance. Therefore, these S&C test indicators have important research and application significance in the field of sports science.

4. Discussion

4.1 Body Morphology

In the survey findings, it was observed that BFR and LBM exhibited higher mean scores and coherence compared to BMI. These two indicators were widely utilized in routine S&C assessments due to their greater accuracy in assessing athletes' body composition. For elite athletes, accurate assessment of BFR and LBM is crucial in optimizing their sports performance levels. In contrast, the BMI only considers the proportion of height and weight, failing to differentiate between muscle and fat differences [17]. Therefore, limitations are evident for S&CCs in evaluating athletes' physical status and performance. Additionally, by effectively controlling BFR and increasing LBM, athletes' strength, endurance, and flexibility could be enhanced, thereby improving their athletic performance and preventing sports injuries.

4.2 Physical function

The investigation findings demonstrated a significant correlation between physiological markers such as HR, CK, and LT. However, it was observed during the investigation that, apart from HR, S&CCs rarely conduct tests on physiological indicators like BLA and CK. This scarcity of testing is attributed to various factors including the requirement for specialized training, research personnel, and equipment support, as well as considerations of time and cost, rendering frequent testing impractical. Conversely, S&CCs tended to optimize training regimens by monitoring HR. Monitoring HR ensures maintaining appropriate HR zones during different phases and objectives of training, thereby enhancing training effectiveness. Furthermore, timely monitoring of HR aids coaches in identifying fatigue states and adjusting training loads as necessary to uphold athletes' physical health and competitive readiness [18].

4.3 Physical Fitness

The indicators of physical fitness include aspects such as strength, explosive power, core strength, and strength of both upper and lower limbs. In sports predominantly relying on lower limb performance such as basketball, soccer, and track and field, the demands for lower limb strength and explosive power are particularly pronounced. Athletes rely on the explosiveness of their legs, movement techniques, and bodily coordination to execute various running, jumping, turning, and control movements to achieve technical and tactical objectives during competition. Therefore, S&CCs need to utilize tests relevant to the specific sport to assess and enhance athletes' performance. It was noteworthy that although some maximal strength tests exhibited high relevance to specific sports, S&CCs in this study seldom employed 1RM testing due to its inherent safety risks, which could increase the likelihood of athlete injury. Instead, a more common approach involves testing with fixed loads or utilizing Velocity-Based Training (VBT) to evaluate athletes' performance.

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4.4 Functional evaluation

In the functional evaluation indicators, the average values of FMS and YBT were the highest and exhibited the lowest CV, which may be closely related to the widespread adoption of FMS for evaluation by Chinese national teams in recent years. The scores of the other three functional tests were relatively close, which may be associated with the understanding and mastery of these tests by S&CCs. The results revealed that S&CCs from abroad generally held master's degrees in fields related to S&C, while domestic S&CCs mostly possessed undergraduate or master's degrees, but not all had their professional focus in S&C nor do they necessarily hold relevant certifications. These differences have influenced to some extent the understanding and application of S&C tests by S&CCs.

4.5 Limitations of S&C testing

The implementation of S&C testing faces various limiting factors, with the influence of head coaches representing the largest proportion (27.7%) (Table 3). This phenomenon can be explained from several aspects. Firstly, head coaches play a crucial role in the training team, as they are responsible for devising training plans, scheduling training sessions, and overseeing athletes' training progress. Therefore, the attitudes, opinions, and decisions of head coaches directly affect the conduct of S&C testing. Secondly, head coaches may adjust the content, standards, and frequency of testing based on their understanding and expectations of the athletes, thus exerting a significant influence on the testing results. Additionally, head coaches may integrate S&C testing with training goals and competition plans to ensure that the test results effectively guide training and improve the overall team performance.

Apart from head coaches, other influencing factors also held significance in S&C testing. Time was considered the second-largest limiting factor (25.8%), indicating that S&C testing required substantial time and resource investment. S&CCs conducted an average of 4.6 S&C training sessions per week with athletes, with a maximum of 8 sessions per week, suggesting that the frequency of S&C testing may be limited within busy training schedules. Equipment (17.5%) and costs (10.9%) were also constraints, as conducting S&C testing requires appropriate equipment and facilities, potentially incurring certain expenses, which also contributes to the high correlation but low utilization of S&C testing indicators with sports. Additionally, limitations in the number of S&CCS in a team, their expertise, and leadership (6%) also affected the implementation of S&C testing. Furthermore, S&C testing required the cooperation of other personnel, with the highest proportion being rehabilitation therapists (28.9%) (Table 4), followed by assistant coaches, including nutritionists, psychologists, and technical analysts (27.7%). This is because rehabilitation therapists are closely involved in athletes' physical recovery and injury prevention, while assistant coaches provide crucial assistance and support during the testing process, which directly impacts the quality and effectiveness of the tests.

Moreover, the limitations of S&C testing were also influenced by the proficiency of S&CCs themselves. Through survey analysis, it was found that there were differences in coaching levels between domestic and foreign S&CCs, with the average coaching level of domestic coaches being 6.9 and that of foreign S&CCs being 7.6, indicating certain differences in the coaching level of domestic S&CCs. These differences included educational background, understanding of sports, interdisciplinary knowledge, communication skills, interpersonal skills, practical skills, and rehabilitation knowledge. Therefore, enhancing the comprehensive qualities and professional levels of S&CCs, strengthening domestic and international exchanges and learning, improving educational levels, and technical expertise are of great significance for improving the quality and effectiveness of S&C training and testing.

Table 3: Factors limiting the conduct of S&C testing.

Limiting Factors	Equipment	Site	Cost	Head Coach	Time	Other
Percentage	17.5%	9.5%	10.9%	27.7%	25.8%	6.0%

Table 4: S&C test co-ordinators.

Position	Rehabilitation Specialists	Team Doctors	Head Coaches	Assistant Coaches
Percentage	28.9%	22.9%	24.1%	27.7%

5. Conclusions

This study delved into the cognitive understanding of high-level S&CCs on S&C testing in China,

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as well as its practical application. The findings revealed a diverse range of metrics involved in S&C testing, encompassing indicators such as heart rate, body fat rate, lean body mass, back squat, bench press, deadlift, vertical jump etc. However, practical implementation of S&C testing posed numerous challenges including scheduling constraints, equipment availability, facility conditions, head coaches, expectations from leadership, and the composite impact of individual S&C coaching proficiency. Currently, disparities exist among S&CCs both domestically and internationally, particularly evident in educational backgrounds, interdisciplinary knowledge reservoirs, accreditation of S&C qualifications, and hands-on experience. Nevertheless, with the deepening exchange of knowledge and the rapid evolution within the field of S&C training globally, it is reasonable to anticipate a gradual reduction in such disparities. Looking ahead, with the application of advanced technologies and the establishment of more professional training systems, S&CCs worldwide will be better equipped to confront challenges, elevate their proficiency, and contribute significantly to athletes' performance.

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Table 2: Survey results for level 2 S&C test indicators.

L 1	L 2	Badminton		Swim		Table Tennis		Basketball		Gymnastics		Track and Filed		Volleyball	
		Mean±SD	CV%	Mean±SD	CV%	Mean±SD	CV%	Mean±SD	CV%	Mean±SD	CV%	Mean±SD	CV%	Mean±SD	CV%
Body Morphology	Height&Body Mass	6.9±0.7	10.1%*	7.0±1.8	26.1%*	5.0±2.0	40.0%	9.3±1.2*	12.4%*	8.0±2.6*	33.1%	6.5±0.7	10.9%*	7.0±1.4	20.2%*
	Body Fat Rate	8.1±1.1*	13.1%*	8.0±0.8*	10.2%*	5.3±1.2	21.7%	7.7±0.6*	7.5%*	9.0±1.0*	11.1%*	7.5±0.7*	9.4%*	6.5±0.7	10.9%*
	Lean Body Mass	7.9±1.2*	15.5%*	8.0±0.8*	10.2%*	5.3±1.2	21.7%	8.0±1.0*	12.5%*	9.0±1.0*	11.1%*	8.0±0.0*	0.0%*	6.5±0.7	10.9%*
	Body Mass Index	5.0±1.5	30.6%	2.0±0.8	40.8%	4.3±2.9	66.6%	6.0±1.7	28.9%	1.7±0.6	34.6%	5.5±2.1	38.6%	1.5±0.7	47.1%*
Physical Function	Heart Rate	8.7±1.5*	17.2%*	9.0±0.8*	9.1%*	7.7±1.2*	15.1%*	7.7±2.1*	27.2%	7.7±2.1*	27.2%	8.5±0.7*	8.3%*	7.5±0.7*	9.4%*
	Blood Pressure	5.4±0.8	14.5%*	7.0±1.2	16.5%*	4.3±1.5	35.3%	5.3±1.5	28.6%	6.3±0.6	9.1%*	7.5±0.7*	9.4%*	5.0±1.4	28.3%*
	Blood Lactic Acid	7.9±1.5*	18.6%*	9.3±0.5*	5.4%*	5.3±2.1	39.0%	7.3±0.6	7.9%*	8.0±2.0*	25.0%	7.5±0.7*	9.4%*	7.5±0.7*	9.4%*
	Creatine Kinase	7.9±1.6*	20.0%*	8.3±1.0*	11.6%*	4.7±1.5	32.7%	8.0±1.0*	12.5%*	8.3±1.5*	18.3%*	8.0±1.4*	17.7%*	7.0±1.4	20.2%
	Lung Capacity	7.6±0.8*	10.4%*	9.5±0.6*	6.1%*	6.3±0.6	9.1%*	7.3±0.6	7.9%*	7.0±1.0	14.3%*	8.0±1.4*	17.7%*	5.5±0.7	12.9%*
	Basal Metabolic Rate	7.3±1.1	13.1%*	9.5±0.6*	6.1%*	4.7±1.5	32.7%	6.7±0.6	8.7%*	5.3±3.1	57.3%	7.5±0.7*	9.4%*	6.0±0.0	0.0%*
	Lactate Threshold	8.1±1.1*	13.1%*	8.8±1.3*	14.4%*	4.3±1.5	35.3%	7.3±0.6	7.9%*	7.0±2.6	37.8%	7.5±0.7*	9.4%*	8.5±0.7*	8.3%*
	VO_2max	7.7±1.4*	17.9%*	9.5±1.0*	10.5%*	7.0±1.0	14.3%*	9.0±0.0*	0.0%*	8.0±2.0*	25.0%	8.5±0.7*	8.3%*	8.5±0.7*	8.3%*
Physical Fitness	Bench Press 1RM	8.0±1.2*	14.4%*	7.0±0.0	0.0%*	4.7±2.5	53.9%	6.7±0.6	8.7%*	9.7±0.6*	6.0%*	7.0±1.4	20.2%	5.5±0.7	12.9%*
	Bent-over row 1RM	7.0±2.0	28.6%	8.5±1.3*	15.2%*	5.7±1.5	27.0%	6.3±1.5	24.1%	8.3±1.2*	13.9%*	7.0±1.4	20.2%	5.5±0.7	12.9%*
	Grip 1RM	8.3±1.3*	15.1%*	7.0±1.4	20.2%	7.0±1.0	14.3%*	6.7±1.2	17.3%*	8.0±1.0*	12.5%*	5.5±2.1	38.6%	5.5±0.7	12.9%*
	Deadlift 1RM	7.9±1.1*	13.6%*	7.0±0.8	11.7%*	6.7±1.5	22.9%	9.3±0.6*	6.2%*	8.7±1.5*	17.6%*	8.5±0.7*	8.3%*	6.5±2.1	32.6%
	Back Squat 1RM	8.9±1.1*	12.1%*	7.0±0.8	11.7%*	6.0±1.7	28.9%	9.3±0.6*	6.2%*	8.7±1.5*	17.6%*	8.5±0.7*	8.3%*	7.0±1.4	20.2%
	Power Clean 1RM	6.9±1.5	21.3%	7.5±1.0*	13.3%*	4.0±1.0	25.0%	9.0±1.0*	11.1%*	8.0±1.7*	21.7%	6.5±3.5	54.4%	6.0±0.0	0.0%*
	Snatch 1RM	6.3±1.5	21.3%	7.5±1.0*	13.3%*	4.0±1.0	25.0%	7.0±2.6	37.8%	6.3±1.2	18.2%*	6.5±3.5	54.4%	7.0±1.4	20.2%
	Standing Long Jump	8.0±07*	8.8%*	9.0±0.8*	9.1%*	7.6±1.2*	15.7%*	9.0±1.0*	11.1%*	8.7±1.5*	17.6%*	7.5±0.7*	9.4%*	8.5±0.7*	8.3%*
	Vertical Jump	8.6±1.0*	11.4%*	8.3±0.5*	6.1%*	7.7±1.1*	14.3%*	9.0±1.0*	11.1%*	9.0±1.0*	11.1%*	8.0±0.0*	0.0%*	3.5±0.7	20.2%
	Sitting/Standing Ball Push	6.9±2.8	40.8%	5.0±2.4	49.0%	6.3±2.5	39.7%	8.0±1.7*	21.7%	4.7±1.5	32.7%	7.5±0.7*	9.4%*	3.5±0.7	20.2%
	Medicine ball throw	6.9±3.0	44.1%	5.5±2.6	48.1%	5.3±3.1	57.3%	7.7±2.1*	27.2%	4.7±1.5	32.7%	7.5±0.7*	9.4%*	3.5±0.7	20.2%
	Reactive Strength Index	9.0±1.0*	11.1%*	8.3±1.3*	15.3%*	7.7±0.6*	7.5%*	8.3±1.5*	18.3%*	9.0±1.0*	11.1%*	8.5±0.7*	8.3%*	7.0±1.4	20.2%
	Pull Up	8.0±1.4*	17.7%*	8.5±1.0*	11.8%*	4.3±2.5	58.1%	8.0±1.0*	12.5%*	7.7±2.3*	30.1%	7.0±1.4	20.2%	8.5±0.7*	8.3%*
	Push Up	7.0%2.4	34.0%	5.3±2.4	45.0%	3.7±1.5	41.7%	8.0±1.0*	12.5%*	7.7±2.3*	30.1%	7.0±1.4	20.2%	8.0±1.4*	17.7%*
	Arms Curl&Extension	6.4±2.9	45.7%	6.3±2.9	46.0%	2.7±1.2	43.3%	6.7±2.5	37.7%	7.3±2.1	28.4%	7.0±1.4	20.2%	5.0±0.0	0.0%*
	Fixed load Squat	7.0±2.2	31.9%	4.5±1.9	42.6%	4.7±2.3	49.5%	8.3±0.6*	6.9%*	3.7±1.5	41.7%	7.5±2.1*	28.3%	7.0±1.4	20.2%
	Fixed load Bench Press	7.0±2.2	31.9%	4.5±1.9	42.6%	3.0±2.6	88.2%	7.3±1.2	15.7%*	8.7±0.6*	6.7%*	6.5±0.7	10.9%*	7.0±1.4	20.2%
	Abdominal Endurance	7.7±1.6*	20.8%	8.0±0.0*	0.0%*	6.3±0.6	9.1%*	7.7±1.2*	15.1%*	8.3±0.6*	6.9%*	7.0±0.0	0.0%*	5.5±0.7	12.9%*
	Back Endurance	7.7±1.6*	20.8%	8.0±0.0*	0.0%*	6.7±1.2	17.3%*	8.3±1.2*	13.9%*	8.0±0.0*	0.0%*	7.0±0.0	0.0%*	5.5±0.7	12.9%*
	Sprint	8.6±0.8*	9.2%*	3.5±2.4	68.0%	8.3±0.6*	6.9%*	8.3±1.5*	18.3%*	8.7±1.5*	17.6%*	7.0±0.0	0.0%*	6.5±2.1	32.6%
	5-10-5 Agility	9.0±0.8*	9.1%*	2.0±1.4	70.7%	8.0±0.0*	0.0%*	9.0±1.0*	11.1%*	5.0±2.6	52.9%	6.0±1.4	23.6%	6.5±2.1	32.6%
	T-Agility	8.1±1.6*	19.3%*	2.0±1.4	70.7%	7.7±0.6*	7.5%*	8.3±1.5*	18.3%*	4.3±2.1	48.0%	6.5±0.7	10.9%*	6.5±2.1	32.6%
	Joint Range of Motion	8.9±0.7*	7.8%*	8.8±0.5*	5.7%*	9.0±1.0*	11.1%*	9.0±1.0*	11.1%*	9.7±0.6*	6.0%*	7.0±1.4	20.2%	9.5±0.7*	7.4%*
	Anaerobic Test	8.1±1.6*	19.3%*	6.8±1.3	18.6%*	6.0±2.6	44.1%	8.0±1.0*	12.5%*	7.0±2.6	37.8%	6.5±0.7	10.9%*	5.5±0.7	12.9%*
Functional Evaluation	Functional Movement Screen (FMS)	7.9±1.6*	20.0%*	7.5±1.2*	16.0%*	4.3±1.5	35.3%	7.3±0.6	7.9%*	7.7±0.6*	7.5%*	7.0±1.4	20.2%	7.0±1.4	20.2%
	Selective Functional Movement (SFMA)	7.6±1.6*	21.4%*	6.0±1.6	27.2%	5.3±2.1	39.0%	7.0±0.0	0.0%*	5.3±1.5	28.6%	8.0±1.4*	17.7%*	8.0±0.0*	0.0%*
	Y-Balance Test (YBT)	8.0±1.4*	17.7%	7.3±1.7	23.6%	5.7±2.3	40.8%	7.7±0.6*	7.5%*	7.0±1.0	14.3%*	7.0±1.4	20.2%	7.0±1.4	20.2%
	Functional Capacity Screen (FCS)	7.0±1.9	27.4%	6.5±1.9	29.5%	4.0±1.7	43.3%	7.7±0.6*	7.5%*	5.7±3.8	66.8%	8.0±1.4*	17.7%*	6.5±0.7	10.9%*
	Functional Breath Screen (FBS)	6.3±1.4	22.0%	7.3±1.0	13.2%*	4.3±1.5	35.3%	7.3±0.6	7.9%*	5.7±1.5	27.0%	7.0±1.4	20.2%	7.0±1.4	20.2%

Note: * refers to a single item meeting the preset standard; 1RM refers to One Repetition Maximum.