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Resistance Training, Perceived Motor Function, and Injury Preventive Behavior among International Students in Shanghai: The Moderating Role of Training Supervision Quality

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ABSTRACT

Purpose: *This study investigates the interplay among resistance training, perceived motor function, injury-prevention behavior, and the quality of training supervision among international college students in Shanghai, positioning resistance training as a health-related adaptation practice influenced by factors such as training background, language access, institutional support, and recreational systems.*
Method: *Utilizing a quantitative cross-sectional survey design, data were collected from 412 international students via a structured questionnaire employing 5-point Likert scales. Analysis was conducted through partial least squares structural equation modeling to evaluate measurement quality, mediation, moderation, and explained variance.*
Findings: *Perceived motor function and injury prevention behavior are positively associated with resistance training. Additionally, perceived motor function is positively correlated with injury prevention behavior and partially mediates the relationship between resistance training and injury prevention behavior. Training supervision quality is also positively associated with injury-prevention behavior, reinforcing the connection between resistance training and injury prevention.*
Implications: *Understanding the exercise behavior of international students extends beyond personal motivation and access to fitness facilities, as it is shaped by institutional factors that influence their ability to safely engage in training activities. Universities enrolling international students are encouraged to*

strengthen the links among recreational services, student well-being, and support systems to provide clear induction processes, accessible supervision, and culturally sensitive exercise guidance.

Keywords: resistance training, motor function, injury preventive behavior, international students, campus recreation, training supervision quality, Shanghai

INTRODUCTION

University students experience a pivotal phase in their health habits, which is significantly influenced by academic pressure, erratic sleep, sedentary lifestyles, diet changes, and exercise variability. Current public health recommendations stress the need for adults to engage in muscle-strengthening activities at least twice weekly, as in addition to aerobic exercise, muscular fitness is essential for injury resilience (Bull et al., 2020). Resistance training has thus emerged as critical not only for athletes but also for nonelite young adults who need improved movement control and tissue tolerance for safer participation in sports (Faigenbaum et al., 2015).

The fragmented nature of college students' physical activities contributes to avoidable injuries because of insufficient systematic training, rapid increases in exercise volume, neglect of warm-up routines, and fatigue impacting performance. Evidence underscores that both young people and adults can reduce injury risk through well-guided strength and neuromuscular training (Lauersen et al., 2018; Wu et al., 2024). Importantly, the benefits of resistance training extend beyond strength, enhancing balance, coordination, trunk stability, and task-specific movement control, which are collectively categorized as 'motor function' (Legerlotz et al., 2016; Bagherian et al., 2018; Li et al., 2025).

For international students, exercise is influenced by their adaptation to university settings, knowledge of recreational resources, and the institutional support available. The motivations for exercise differ between international and domestic students, with studies highlighting that the former face greater intrapersonal and structural barriers to participation (Cho et al., 2020; Cho and Price, 2018). Moreover, recent findings link international students' well-being to perceptions of health, community satisfaction, belonging, institutional support, and culturally responsive interventions (Hsieh & Watson, 2025; Xiong et al., 2024).

This research emphasizes that assessing international students' exercise habits requires more than mere access to facilities; it also requires understanding their comfort and confidence levels when they use equipment and seek assistance. Barriers such as cultural challenges, academic pressure, and environmental factors also affect physical activity among international students (Yin et al., 2024). Given the notable injury prevalence among Chinese university students (Xu et al., 2024), which is linked to poor movement practices, environmental factors, and excessive

physical loads, there is a pressing need for effective interventions focusing on resistance training as a preventive health strategy.

This study aims to bridge these theoretical gaps by integrating resistance training, injury preventive behavior, and perceived motor function in the context of international students and proposes that training supervision quality may enhance injury prevention. The correlations between resistance training participation, perceived motor function, and behavior aimed at injury prevention among international students in Shanghai should be analyzed. Ultimately, this research contributes to an integrated exercise behavior model while promoting international student studies by contextualizing campus resistance training as a health adaptation practice supported by the institution.

LITERATURE REVIEW

PARTICIPATION IN International Student Adaptation and Campus Exercise

To interpret resistance training behavior in this study, it is necessary to have some understanding of international student research. Mobility to a host university is more than an academic transition. It also involves students learning new routines, new spaces, new peer norms, new service systems and new institutional expectations. Campus sports and recreation form a part of this environment, as it influences how students manage health, social connection and well-being outside of the classroom. The relevance of recreation participation and leisure constraints related to international student adjustment and campus inclusion has been demonstrated through previous research (Cho & Price, 2018; Glass et al., 2014). In the context of exercise, Cho et al. (2020) reported that international students differed from domestic students in their motivation for exercise, indicating that exercise messages sent on campus to a general student population might not fully cater to the needs of international students.

The present study is also relevant because of the recent international student scholarship. Kim (2024) reported that perceived health status and community satisfaction were important to international students' subjective well-being. When designing support and countermeasures, recognizing the unique stressors and needs of tertiary students both within and outside the country is important, as highlighted by Xiong et al. (2024). Social and academic support were found to be positively correlated with well-being for both Indian and international students by Beri et al. (2025), and Hsieh and Watson (2025) reported that structured activities in positive psychology can positively influence international students' well-being and belonging. Mai et al. (2025) also suggested that international student support is a structural issue that includes access, belonging, proactive advising, peer mentorship and culturally responsive training. These studies focus on the quality of supervision as more than merely a technical training variable. Supervision quality also illustrates how understandable, safe and accessible exercise participation is in practice in an international student context.

Effects of Resistance Training on Motor Function

The text examines the relationship between resistance training and motor function, highlighting its superiority over isolated strength outcomes. Faigenbaum et al. (2015) suggest that integrative training, encompassing both resistance exercise and motor skills, aids youth in mastering complex movements required in sports. Granacher et al. (2016) further reported that well-selected resistance training significantly enhances muscular fitness and athletic performance in young athletes. The principles derived from these studies are applicable to university students, emphasizing that progressive, task-relevant strength training improves movement quality.

Mechanistically, resistance training challenges the neuromuscular system, fostering stabilization, acceleration, deceleration, and joint coordination. Legerlotz et al. (2016) detail how resistance training affects motor performance through neural and morphological pathways. Corresponding intervention studies support these findings; for instance, Bagherian et al. (2018) reported that an eight-week core stability program improved functional movement and dynamic postural control in college athletes. Additionally, Bennett et al. (2019) reported that both movement quality-focused and traditional resistance training enhanced performance, whereas Li et al. (2025) reported improvements in functional movement and fitness among male university students after eight weeks of functional training. Finally, Wang et al. (2024) reported that functional strength exercises not only improved fitness outcomes but also enhanced movement quality in adolescents, underscoring the transferable motor benefits of integrated loading strategies across young populations.

Therefore, on the basis of the theory of neuromuscular adaptation and empirical evidence collected previously, the following hypothesis is proposed:

H1. Resistance training significantly influences motor function.

Direct Effect of Resistance Training on Sports Injury Prevention

The second hypothesis posits that resistance training directly contributes to sports injury prevention. In support of this theory, the injury prevention literature indicates that strength-oriented exercises can significantly reduce the risk of acute and overuse injuries. A systematic review by Lauersen et al. (2018) emphasized that strength training is the most effective method for the primary prevention of sports injuries, demonstrating a dose-dependent and safe approach. Although not all campus sports environments implement controlled interventions, the consensus is that stronger tissues, enhanced load tolerance, and more resilient movement patterns resulting from being physically active can make students less susceptible to common lower extremity and overuse injuries.

Evidence from various intervention studies reinforces this hypothesis. For instance, Kozin et al. (2021) reported that closed chain and eccentric strength exercises led to a decreased incidence of shoulder injuries among student amateur climbers, indicating that specific strengthening exercises can offer protection even among specialized recreational athletes. Additionally, Shen et al. (2020) reported the preventive and therapeutic benefits of functional strength training concerning

calisthenics-related injuries. Collectively, these findings suggest that resistance training can affect injury prevention through both generalized mechanisms, such as increased strength and load tolerance, and sport-specific mechanisms, such as enhanced control of shoulder or lower limb movement. Therefore, the research extends the following hypothesis:

> H2. Resistance training significantly influences sports injury prevention.

How Motor Function Prevents Sports Injuries

The third hypothesis is that motor function plays an important role in the prevention of sports injuries. This proposition is in line with a broad base of screening and movement analysis research that has implied that poor movement control, asymmetry, or unstable landing mechanics are linked to an increased risk of injury. Chang et al. (2020) reported that the use of functional movement and balance-related assessments differentiated junior athletes into groups with high and low risks of sports injury. Jones et al. (2020) further argued that the combination of functional movement and physical performance testing aids in better identification of noncontact injury risk. Although prediction based on screening is never perfect, the general message is clear, and the way individuals move is important for injury prevention.

Recent work also supports the idea of having a multidimensional perspective of motor function and not focusing on a single screen. Asgari et al. (2024) reported that common movement tests, such as the functional movement screen, landing error scoring system, and Y-Balance test, do not capture the same qualities and imply that motor function is a larger domain of movement capacity. Hanes et al. (2022) reported that neuromuscular fatigue further impaired functional movement efficiency in healthy adults, which supports the notion that unstable movement is not only a static characteristic but can also develop during load and fatigue. Buxton et al. (2020) reported that quadrupedal movement training improved dynamic balance, range of motion and upper body function, which further demonstrated the trainability of motor control and its relevance to whole-body physical preparedness. Accordingly, the following hypothesis is proposed:

> H3. Motor function significantly influences sports injury prevention.

Mediating Effect of Motor Function

The fourth hypothesis takes the previous arguments one step further by hypothesizing a mediating effect of motor function on the relationship between resistance training and sports injury prevention. In conceptual terms, mediation refers to the improvement of motor function with resistance training and the improvement of motor function, subsequently increasing the likelihood of movement behavior being safer and injury being prevented. This proposition is attractive in that it explains the fact that the effect of resistance training is not limited to muscular strength alone. Resistance training may have a protective effect on students since it teaches them to organize force, stabilize the trunk, align the joints, and coordinate movement under increasing demands.

Empirically, a number of strands of literature provide support for the two segments of this chain. As noted above, resistance-oriented or functional strength interventions enhance the quality and dynamic control of movement (Bagherian et al, 2018; Bennett et al., 2019; Li et al., 2025). Moreover, the literature on movement quality suggests that biomechanical and motor control factors are strongly related to the risk of injury and the effectiveness of prevention programs (Chang et al., 2020; Jones et al., 2020). The mediating proposition thus brings these strands together instead of seeing them as independent of each other. A student performing resistance training regularly may improve trunk stiffness regulation, single-leg control and landing mechanics, which in turn make prevention decisions more effective because the body is more capable of executing them. Therefore, the present study proposes the following hypothesis:

> H4. Motor function significantly mediates the relationship between resistance training and sports injury prevention.

Training Supervision Quality as a Moderator

This study examines the moderating effect of training supervision quality on the effectiveness of resistance training for injury prevention. It argues that clear coaching, individualized progression, and reliable feedback enhance adherence and understanding. Citing Cornelissen et al. (2023), trainers are essential for effective program implementation. The variability of exercise-based injury prevention results emphasizes the importance of supervision for compliance and execution quality. Additionally, Biscardi et al. (2024) and Kercher et al. (2024) link self-efficacy with strength training responses, indicating that supportive environments foster confidence and consistent participation, which is further supported by Rauff et al. (2022) and Yu et al. (2024) regarding the role of self-efficacy in exercise persistence.

The quality of supervision, for international students, may be particularly significant, as this will diminish uncertainty in an unfamiliar training context. Explanations of technique, individual progression, culturally competent communication and approachable feedback can facilitate students' transformation of gym access to safe participation. This aligns with international studies of students that have found belonging, tailored support systems and institutional support to be key components of student well-being and adjustment (Beri et al., 2025; Hsieh & Watson, 2025; Mai et al., 2025; Marangell & Baik, 2022). In the current model, the quality of supervision is therefore considered a boundary condition that can enhance the impact of resistance training on the adoption of injury-preventive behaviors. On the basis of this reasoning, the final hypothesis is proposed:

> H5. Training supervision quality significantly moderates the relationship between resistance training and sports injury prevention.

Theoretical Framework

Exercises the theoretical approach, which is based on the international research of students. Perceived motor function and injury preventive behavior are

conceptually distinct and related. Perceived motor function is students' perceived ability to move effectively with balance, coordination, dynamic control, landing control and smoothness of movement in sport/exercise. Injury prevention behavior is self-regulatory and routine behavior that is designed to minimize the risk of injury, such as warming up, modifying load as fatigue and pain occur, using injury preventative exercises and responding appropriately to the body's warning signs. Therefore, perceived motor function is a motor function mechanism, and injury prevention behavior is a behavior outcome.

The model is based on three complementary levels of explanation. The neuromuscular adaptation theory can aid in understanding the association between structured resistance training and increased physical capacity, coordination, and dynamic control, as these are the adaptations that occur during resistance training. Second, motor control theory provides us with an understanding of why these capacities are important for safe participation, as strength becomes protective when it is expressed through balance, alignment, load control and efficient movement regulation. Third, an international student support lens sheds light on why access to training does not necessarily yield equal outcomes for all students. International students come to campus with varying levels of prior experience with resistance training, with varying equipment and coaching norms, and varying degrees of self-confidence in seeking help. In this context, training supervision quality acts as a coaching variable and a support condition that works to facilitate facility access and to support sustained participation and safety for students.

This framework (Figure 1) does not imply that the current data actually measure acculturation, belonging, language competency or discrimination. Instead, it sees these as contextual aspects of international students' lives that contribute to the theoretical significance of supervision quality. This distinction is significant for achieving analytical accuracy. The model examines resistance training, perceived motor function, injury prevention behaviors and the quality of training supervision, and the discussion situates these constructs both within the wider international student literature on support, belonging, well-being and institutional accessibility.

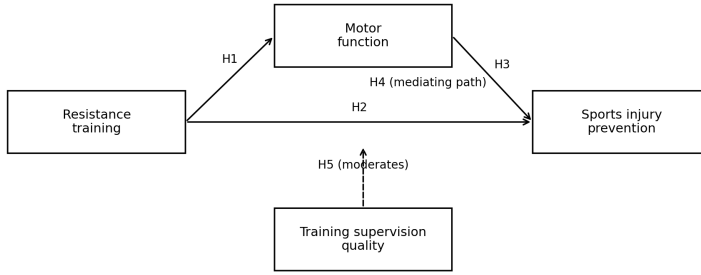

Figure 1: Theoretical Model

METHODOLOGY

This was a quantitative cross-sectional design. A structured questionnaire was given to 412 international students from the universities in Shanghai. Students were recruited via international student offices and campus networks. The target population was spread out across institutions, and access was reliant on the gatekeepers of the universities; thus, nonprobability convenience sampling was used. In this way, students who had recently been exposed to campus sport, gym activity or organized physical activity were reached. However, it also restricts the ability to statistically generalize to other participating institutions. Ethical approval was granted, and informed consent was obtained from all participants prior to completing the questionnaire.

The sampling frame is determined by the Shanghai higher education context, where international students are found at comprehensive, science and technology, business and language and teacher education institutions. The participants were undergraduate or postgraduate international students aged 18–29 years who participated in one or more of the following sports/gym exercises/organized physical activity on campus during the preceding semester. In the modeled sample, 53.2% of the participants identified as male, 45.1% identified as female and 1.7% identified as another sex. The mean age was 22.4 years (SD = 2.3). Approximately 60.9% of them were undergraduates, 28.4% were master's degree students and 10.7% were doctoral students. The modeled sample included students from Asia (39.6%), Africa (24.0%), Europe (18.4%), the Americas (11.9%) and other regions (6.1%) on the basis of their region of origin. The mean residence time in Shanghai was 1.8 years; hence, participants were likely to have had enough time to experience the campus environment to comment on exercise practices and still be able to express the adjustments that are common among students moving internationally.

Self-reported latent variables were used to measure key constructs related to exercise behavior, with a five-point rating scale from 1 (strongly disagree) to 5 (strongly agree). The development of this measurement tool was based on the literature rather than on the creation of a new scale. Constructs in resistance training included regularity, progression, major movement patterns, and attention to technique and recovery. Perceived motor function was gauged through items assessing balance, control during direction changes, landing control, and movement smoothness in sports or exercise. Injury preventive behaviors were evaluated on the basis of warm-up activities, load adjustments when fatigued or injured, injury prevention exercise programs, and perceived benefits of training practices. The quality of supervision was gauged by technique explanations, feedback provided, individual progression assessments, safety reminders, and openness to seeking advice.

These indicators reflect perception-based measures of exercise behavior, movement confidence, and support access rather than objective clinical or performance metrics. As part of a multi-institutional survey focusing on students'

perceived training behaviors, movement confidence, preventive practices, and supervision access, self-reported measures were deemed appropriate, although they do not replace objective assessments such as balance tests, movement screenings, or verified injury records. Consequently, the findings should be interpreted as perceived associations rather than biomechanical evidence.

The study revealed that higher resistance training levels are correlated with improved motor function and promote better injury prevention behaviors, with supervision quality enhancing the relationship between resistance training and injury prevention via an interaction term. The data indicated acceptable internal consistency, with means suggesting a diverse student population rather than elite athletes.

Data analysis followed a partial least squares structural equation modeling reporting strategy. First, descriptive statistics were examined to assess item distributions and construct central tendency. Second, measurement quality was evaluated using Cronbach's alpha, Dijkstra and Henseler's rho_A, Jöreskog's rho_C, average variance extracted and indicator loadings. Third, discriminant validity was assessed using the heterotrait–monotrait ratio and the Fornell–Larcker criterion. Fourth, structural estimates were reported using standardized path coefficients with bootstrapping based on 5,000 resamples. Fifth, effect sizes, coefficients of determination, cross-validated predictive relevance and forecast error indices were reported to assess model quality and practical significance. The use of PLS-SEM was appropriate because the study is prediction oriented, includes mediation and moderation, and estimates relationships among multiple latent constructs measured with several indicators (Becker et al., 2023; Hair et al., 2019).

The choice of PLS-SEM was made because this model is prediction oriented, involves mediation and moderation, and approximates the connections between a number of latent constructs, which are measured using multiple indicators. According to Hair et al. (2019), a PLS-SEM is suitable in situations where the research problem is focused on the explained variance, path estimation, and prediction assessment in sophisticated models. Becker et al. (2023) also stress the significance of clear guidance in the case of PLS-SEM moderation and specifications of models. On this basis, the analytical plan emphasized the quality of measurement, structural paths, magnitude of effects and predictive relevance as opposed to covariance-based global fit itself. Supplementary Table S1 presents the questionnaire profile used in the quantitative phase.

RESULTS

The quantitative analysis resulted in a path model, and the measurement structure was in accordance with the study hypotheses. Notably, prior to the interpretation of the structural model, the sample was a noncompetitive group of students. In the modeled sample, 31.3% were engaged in main activities (gym-based resistance training), 26.0% were team sports, 16.7% were racket sports, 14.6% were endurance-oriented activities, and 11.4% were mixed recreational exercises. Approximately 57% indicated that they had previously worked with resistance training for a period of at least six months; however, only 34% reported always

being supervised when lifting technically challenging movements. This pattern helps to reinforce the relevance of the present model, as it will show that the students have access to exercise but with unequal guidance for training.

Variable reliability and validity

All the constructs had acceptable to strong internal consistency and convergent validity (Table 1). The Cronbach's alpha values were between 0.837 and 0.869, indicating a high degree of reliability, ranging from resistance training to training supervision quality, with both results being perfectly above the commonly accepted threshold of 0.70. Joreskog's rho_c values ranged from 0.839 to 0.870, and the AVE values ranged from 0.568 to 0.589. These results suggest that the indicators were coherent enough in each construct and that each construct accounted for more than half of the variance in the indicators. Taken together, the measurement quality statistics provide a good indication that the modeled instrument is robust enough to proceed with structural interpretation.

Table 1: Variable reliability and validity

Construct	Dijkstra-Henseler's rho (rho_A)	Joreskog's rho (rho_c)	Cronbach's alpha (alpha)	AVE
Resistance training	0.8481	0.8391	0.8371	0.5675
Motor function	0.8609	0.8511	0.8506	0.5886
Sports injury prevention	0.854	0.8445	0.8435	0.5765
Training supervision quality	0.8793	0.8696	0.869	0.5723

Estimated Model

The estimated model with standardized coefficients and explained variance values for the endogenous constructs are shown in Figure 2.

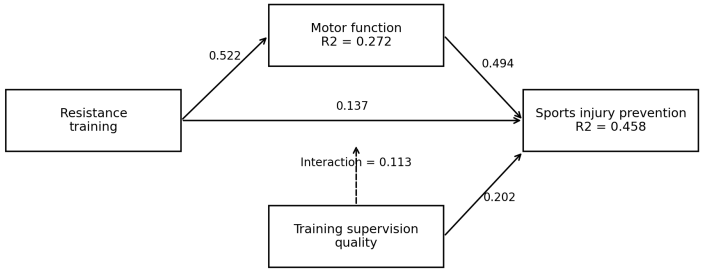

Figure 2: Estimated Model

Measurement item fitness statistics

The item-level statistics in Table 2 show standardized loadings mostly between 0.71 and 0.82, with all being above 0.64. The resistance training items exhibited strong loadings in regularity and progression, whereas the motor function items excelled in balance and coordinated movement control. Sports injury prevention items were consistently loaded on warm-up, fatigue self-regulation, preventive strategies, and protective beliefs. Training supervision and quality items had high loadings for technique explanation and feedback, indicating empirical coherence and conceptual balance in the modeled constructs.

Table 2: Measurement item fitness statistics

Indicator	RT	MF	SIP	TSQ	Mean	SD
RT1	0.8062				3.22	1.15
RT2	0.7913				3.25	1.13
RT3	0.7562				3.23	1.16
RT4	0.6496				3.19	1.18
MF1		0.816			3.29	1.19
MF2		0.7479			3.17	1.12
MF3		0.7622			3.19	1.18
MF4		0.7405			3.23	1.18
SIP1			0.7976		3.24	1.18
SIP2			0.7923		3.16	1.16
SIP3			0.7275		3.18	1.16
SIP4			0.7162		3.17	1.2
TSQ1				0.8243	3.19	1.17
TSQ2				0.7826	3.24	1.19
TSQ3				0.7243	3.19	1.16
TSQ4				0.7322	3.23	1.15
TSQ5				0.7135	3.26	1.18

Discriminant Validity

Discriminant validity was assessed in two ways. First, the HTMT ratios in Supplementary Table S2 all fell below 0.85 and indicated adequate distinctiveness between the constructs. The highest HTMT value was found between motor function and sports injury prevention (0.742), which is theoretically expected given that although better movement quality is related to safer participation, they are not identical. Second, the Fornell–Larcker matrix in Supplementary Table S3

indicates that the square root of the AVE for each construct is greater than the correlations of the other constructs. Taken together, these tests support the conclusion that the latent variables modeled capture separate dimensions of student exercise behavior.

Overview of variable effects

Table 3 summarizes the substantive effects in the model. Resistance training had a medium to large effect on perceived motor function ($\beta = 0.522$, $f^2 = 0.374$) and a weaker direct effect on injury preventive behavior ($\beta = 0.137$, $f^2 = 0.025$). However, the total effect of resistance training on injury prevention behavior was greater when the indirect path through perceived motor function was included (total effect = 0.395). Perceived motor function had the strongest direct effect on injury prevention behavior ($\beta = 0.494$, $f^2 = 0.299$), indicating that movement confidence was the main explanatory mechanism in the model. Training supervision quality also had a positive direct effect on injury preventive behavior ($\beta = 0.202$, $f^2 = 0.064$). The interaction effect between resistance training and training supervision quality was statistically significant, indicating that supervision quality strengthened the relationship between resistance training and injury prevention behavior.

Table 3: Variable effects overview

Effect	Beta	Indirect effects	Total effect	Cohen's f^2
Resistance training -> Motor function	0.522		0.522	0.374
Resistance training -> Sports injury prevention	0.137	0.258	0.395	0.025
Motor function -> Sports injury prevention	0.494		0.494	0.299
Training supervision quality -> Sports injury prevention	0.202		0.202	0.064

R-square statistics Model Goodness of Fit Statistics

As shown in Supplementary Table S4, the model accounted for 27.2% of the variance in motor function and 45.8% of the variance in injury preventive behavior. For an approach that uses behavioral models centered on a heterogeneous group of university population, these are moderate explanatory power values. The cross-validated Q^2 values were positive for both endogenous constructs, indicating some usefulness for predictive purposes. The RMSE and MAE values were close to acceptable values for the prediction of standardized latent scores, suggesting that the model is not only statistically significant but also meaningful for prediction.

Structural Model for Path Analysis

The structural model for path analysis is given in Table 4. The figure is a combination of the standardized coefficients and R^2 values to illustrate how the model works. Resistance training is predictive of motor function, which can predict injury prevention. A residual direct relationship between resistance training and injury prevention suggests only partial rather than total mediation. Training supervision quality enhances the overall preventive environment and reinforces the slope between resistance training and sports injury prevention.

Table 4: Path Analysis

Hypothesis/Path	Original Sample	SD	T Statistics	p
H1: Resistance training -> Motor function	0.522	0.04	12.988	< .001
H2: Resistance training -> Sports injury prevention	0.137	0.045	3.056	.002
H3: Motor function -> Sports injury prevention	0.494	0.042	11.745	< .001
H4: Resistance training -> Motor function -> Sports injury prevention	0.258	0.03	8.565	< .001
H5: Resistance training × Training supervision quality -> Sports injury prevention	0.113	0.035	3.261	.001

The moderation result is understood as evidence of a boundary condition. The results revealed that there was a significant interaction, indicating that the relationship between resistance training and preventative behaviors for injury was stronger when the quality of training supervision was also higher. However, this present report presents the overall interaction estimate, not the conditional estimates at the level of each case, and does not plot simple slopes; thus, the analysis cannot be interpreted as specifying the exact size of the slope at each level of supervision quality: low, medium and high. Future research should provide conditional effects and visualize the interaction so that the supervision quality can be better interpreted in practice.

DISCUSSION

This study aimed to explore the relationships between resistance training and motor function perception and injury prevention behavior among international college students in Shanghai. The results suggest an integrated interpretation whereby resistance training was directly related to injury prevention behavior and indirectly related to perceived motor function. Students who perceived more structured resistance training also tended to perceive more advantages in terms of movement (balance, movement control, landing control, and coordination) and demonstrated safer training practices. The results thus indicate that the protective

effect of participation in resistance training may be related not only to frequency but also to whether the training provides the ability to move in sports and exercise.

These findings indicate that resistance training is being increasingly recognized as a means for enhancing motor development rather than solely for improving muscular fitness. This insight is particularly pertinent for college students, who may have varied backgrounds in physical training, limited experience in sports, or periods of inactivity, challenging the assumption of their inherent movement competence. Research has shown that both movement-focused and strength-oriented training can significantly improve functional movement, postural control, and overall physical preparedness in younger people (Bagherian et al., 2018; Bennett et al., 2019; Li et al., 2025).

The support for H2 indicates a direct relationship between resistance training and injury prevention behavior, even when motor function is considered. This relationship can be attributed to several mechanisms: First, resistance training enhances tissue capacity and tolerance to mechanical stress, enabling students to better meet sports demands (Lauersen et al., 2018). Second, structured training encourages the development of comprehensive exercise habits, such as warming up and managing fatigue. Third, resistance training increases confidence and self-regulation, prompting students to adjust their activity intensity or stop when symptoms arise. These findings align with research showing the preventive effects of strength training among various active populations (Kozin et al., 2021; Shen et al., 2020). However, the smaller magnitude of the direct path compared with the mediated path underscores that the advantages of prevention are maximized when resistance training leads to noticeable movement competence rather than merely gym-based participation.

H3 effectively relates motor function to sports injury prevention, highlighting the importance of dynamic stability and coordinated movement for converting preventive intentions into action. This finding aligns with the literature indicating that the quality of movement influences injury risk, albeit imperfectly (Chang et al., 2020; Jones et al., 2020; Asgari et al., 2024). This study emphasizes that while self-reported motor function is not a comprehensive predictor of injury, movement ability is a crucial determinant of safe sport participation. Under real-world conditions, such as fatigue and unpredictable environments, enhancing motor function is vital, as demonstrated by Hanes et al. (2022) in terms of the effects of fatigue on movement efficiency.

The key theoretical input of the model is mediation for H4. It posits that perceived motor function is not just another positive outcome of resistance training; it is a process in which resistance training becomes connected with injury preventive behavior. This is a discovery that can help bind the threads of literature together, which are frequently ignored in isolation. Studies on resistance training tend to focus on load and strength/performance, whereas studies on injury prevention tend to focus on screening or warm-up exercises and the quality of movement. These perspectives are complementary, as suggested by the mediation model. Resistance training could serve as a developmental platform, and perceived motor function could be the proximal pathway through which training benefits translate to safer participation. Increasing gym attendance is not enough

for universities. The impact of training quality and training on students' perceived movement control is at the core of prevention.

This assertion is also in line with the findings that self-efficacy is linked to the results and participation in resistance training. Kercher et al. (2024) reported that self-efficacy is related to resistance training results in adults. Yu et al. (2024) similarly reported that self-efficacy was related to physical activity among college students. Rauff and Kumazawa (2022) reported that more active first-year undergraduates had greater self-efficacy in overcoming activity barriers. Unambiguous feedback and customized development in the current environment could thus facilitate injury prevention behavior in part because of decreased ambiguity and increased willingness to train students on a regular and safe basis.

An international research contribution is that a campus's exercise behavior is understood within the context of the campus support environment of the host university. International students might have varying experiences in using gym or being coached, language skills and confidence, and expectations of seeking assistance. However, resistance training must not be interpreted solely as individual motivation, personal discipline or physical capacity. It should also be understood as a practice that is influenced by what the university renders intelligible, safe and socially acceptable in terms of training spaces. This finding is in line with research indicating that international students are different from domestic students in terms of their motivations to engage in physical activity and constraints in recreation (Cho et al., 2020; Cho & Price, 2018), that perceived health and community satisfaction are correlated with international students' subjective well-being (Kim, 2024), and that the themes of support, belonging and tailored intervention have been identified in recent studies on international students (Beri et al., 2025; Hsieh & Watson, 2025; Mai et al., 2025; Marangell & Baik, 2022; Xiong et al., 2024).

The moderation results should be interpreted cautiously. The positive interaction coefficient indicates that the association between resistance training and injury prevention behavior was stronger in contexts characterized by better supervision quality. Because the present revision does not include case-level conditional effect estimation or plotted simple slopes, the moderation should be read as evidence of a boundary condition rather than as a fully mapped practical gradient. Future analyses using field-based data should visualize the interaction at low, moderate, and high levels of supervision quality to clarify the magnitude of the effect.

The policy implication is that universities should not see entry to the gym as the end point of support for international students. A more student-specific approach would relate campus recreation to international student orientation, well-being services and student affairs practices. It might involve multilingual induction of gym rules and equipment use, obvious signage for safety information, supervised resistance training sessions, visible trainer presence for complex exercises and links between international student offices and recreation services. Gym management strategies are not just these actions. They are institutional support measures that enable international students to comprehend how to interact safely in a host university context.

The results also indicate that the quality of supervision can be considered an equity issue. Training information, safety rules and protocols for seeking assistance may be included in the local language, informal peer culture, or assumptions that students have had gym experience, which may hinder some international students from taking full advantage of the campus recreation services offered. Universities can narrow this gap by providing clear, culturally appropriate and low-cost guidance on exercise. That does not have to be based on the assumption that international students are vulnerable. Instead, it is important to understand that safe engagement is a function of how well the institution can convey expectations, progression, risk indicators and available support.

A practical approach would be to provide a progression pathway for international students who may want to start resistance training at a recreation center. These can be short, skill-focused workshops, trainer-led technique checks, and beginner-friendly programs that focus on progression and recovery and can involve coordination between coaches and international student support staff. This finding is in line with the study's results, as resistance training correlated better with injury prevention behavior when supervision quality was higher. They also resonate with international student research, which places a focus on belonging, support and culturally responsive services as factors of student wellbeing.

Taken together, the results of the model indicate that resistance training is most strongly linked with safer participation when it is connected with perceived movement competence and supportive supervision. For universities that enroll international students, this means that gym access should be accompanied by clear guidance, approachable feedback and progress that can be understood across different languages and cultures. These implications should be interpreted cautiously because the study is cross-sectional, relies on self-reported measures and does not include objective movement tests or verified injury records. Nevertheless, the findings provide a useful basis for future field-based and longitudinal studies that examine how campus recreation systems support international students' health behavior, belonging and adaptation.

This study has several limitations. First, its cross-sectional design prevents causal inference, making the direction of associations uncertain. Second, self-reports of focal constructs may introduce biases such as recall bias and social desirability bias. Third, perceived motor function and injury preventive behavior were not validated through objective measures. Additionally, important constructs such as acculturative stress and perceived discrimination were not included, which limits claims about international student adaptation mechanisms. Future research should address these variables and examine their potential mediatory or moderating effects. Finally, the use of aggregate interaction estimates for moderation results limits practical interpretation, and nonprobability sampling affects the generalizability of the findings to other institutions and students.

CONCLUSION

Resistance training, perceived motor function, injury prevention behavior, and training supervision quality were the main topics of this study's development and testing of an integrated model among foreign college students in Shanghai. Resistance training, perceived motor function, and injury avoidance were shown to be positively correlated, with some mediated by perceived motor function and improvement through quality supervision. This study highlights the need for easily available supervision and support mechanisms for foreign students by emphasizing how effective resistance training in academic contexts promotes movement competence and confidence. Objective mobility metrics, injury outcomes, and elements such as acculturative stress and belonging should be included in future studies.

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- ☐ *None*
- ▰ *Some sections, with minimal or no editing*
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- ☐ *Entire work, with minimal or no editing*
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