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ORIGINAL ARTICLE

Psychometric Properties and Gender Invariance of the Academic and Athletic Identity Scale (AAIS): A Study in the Chinese Cultural Context

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Identity, University Athletes, Validation, Invariance.

ABSTRACT

Background. Student-athletes face unique challenges balancing academic and athletic roles. Understanding how these two identities interact and influence student-athletes self-perception is essential for assessing their ability to manage both effectively. **Objectives.** The study aimed to validate the Chinese version of the Academic and Athletic Identity Scale (AAIS-C) among Chinese university athletes and test its measurement invariance across gender groups. **Methods.** 464 Chinese university athletes (M = 20 years, SD = 1.62) participated. The English version of AAIS was translated into Chinese using a forward-backward translation procedure. Confirmatory factor analysis (CFA) was conducted to examine the two-factor model. Multi-group confirmatory factor analysis (MG-CFA) was employed to test measurement invariance across gender. **Results.** CFA results indicated that the hypothesized two-factor model fit well (CFI = 0.978, TLI = 0.972, SRMR = 0.023, RMSEA = 0.051). Cronbach's alpha values for academic and athletic identity were 0.895 and 0.914, respectively, and their composite reliability values were 0.895 and 0.915, indicating high internal consistency and convergent validity. The AVE values for academic and athletic identity were 0.631 and 0.641, demonstrating adequate convergent validity. A negative correlation (r = -0.246) between the two identities confirmed discriminant validity. Multi-group CFA results demonstrated measurement invariance for AAIS-C across gender groups. **Conclusion.** The AAIS-C is a valid tool for assessing identity among Chinese university student-athletes. Furthermore, the scale is suitable for making meaningful comparisons across gender groups, with stable measurement properties and cross-cultural applicability.

INTRODUCTION

Identity constitutes a fundamental aspect of an individual's self-concept, shaping self-perception and societal interactions (1). It plays a critical role in human experience and behavior, providing a structured framework for individuals to navigate their relationships with the external world. In the late 1970s, Markus (2) introduced the concept of specific identities as cognitive structures, known as self-schemas. These self-schemas are organizational mechanisms that process and integrate self-relevant information from lived experiences. Individuals typically hold multiple self-schemas across different roles and contexts, though a comprehensive exploration of these various identities lies beyond the scope of this review. Identity functions as a mental filter, systematically selecting and organizing external information, which enables individuals to construct a stable and coherent sense of self. This structured cognitive process facilitates emotional and behavioral regulation, shapes social interactions, and enhances the capacity to manage life's challenges (3). Therefore, identity plays a central role in how individuals view themselves and understand their societal roles.

In the field of sports psychology, identity research has a well-established history. Brewer et al. (4) first introduced the concept of athletic identity in the early 1990s, which refers to the extent to which an individual identifies as an athlete. Research has demonstrated that athletic identity exerts a dual influence on athletes' mental health and career development. On the one hand, a strong athletic identity can promote career maturity, assist athletes in setting and achieving long-term goals, and enhance self-esteem, confidence, and social support, fostering resilience and well-being (5, 6). However, an overly rigid athletic identity may elevate the risk of burnout, particularly in high-pressure environments, and can exacerbate psychological challenges in the event of injury (7).

Furthermore, athletes with a powerful athletic identity frequently encounter greater difficulties adapting to life after their sports career, as their self-concept becomes heavily intertwined with athletic performance (8, 9). Future research should aim to balance the positive contributions of athletic identity with its potential adverse effects. As research in this area evolves, the dual identity of university athletes—balancing academic and athletic roles—has emerged as an important focus of study.

For university athletes, the formation and maintenance of identity are shaped mainly by interactions within their academic and athletic environments, including engagement with school, sports teams, classes, teachers, coaches, teammates, and peers. Students must invest substantial time and effort into academic pursuits, such as attending classes, completing assignments, and preparing for exams. Simultaneously, athletes must allocate significant time to training, competitions, and physical conditioning, placing considerable demands on their mental and physical well-being (10). Depending on the context, either their student or athlete identity may take precedence. Previous research has demonstrated that these dual identities are pivotal in academic and athletic performance (11-13). For instance, Yopyk and Prentice (13) found that when student-athletes academic identity was emphasized, their performance in academic tasks improved, whereas their academic performance diminished when their athletic identity was prioritized. The coexistence of these dual identities introduces unique challenges for student-athletes, highlighting the importance of accurately measuring this duality in academic research.

Accurate measurement tools are essential to understand individuals' perceptions and emotions in identity research. In athletic identity research, the Athletic Identity Measurement Scale (AIMS) is widely used, assessing athletes' experiences through dimensions like social identity, exclusivity, and negative affectivity (14). However, various studies have proposed different structural models for AIMS, particularly in the debate between unidimensional and multidimensional models, suggesting that AIMS may not fully capture the complexity of athletic identity (8, 15). Harrison et al. (11) developed the Baller Identity Measurement Scale (BIMS), based on AIMS, which was intended to assess student-athletes role identities to address these limitations. Nevertheless, most BIMS items focus on emotional attachment to the athletic role without explicitly considering academic identity (16). Researchers have also analyzed the NCAA's 2006 Growth Opportunities Aspirations and

Learning of Students in College Survey (GOALS) to explore factors influencing academic performance, such as sports participation and coaching. However, its extensive length (260 items) and indirect assessment of academic identity limit its efficacy (17, 18). To fill these gaps, Yukhymenko-Lescroart et al. (19) developed the 11-item Academic and Athletic Identity Scale (AAIS), which offers a comprehensive assessment of student-athletes dual academic and athletic identities, providing a more holistic understanding of their psychological state. The AAIS integrates both identities and has demonstrated strong reliability and validity across diverse populations, including student-athletes from Brazil, Ukraine, Japan, and France (20-23).

In China, research has predominantly focused on athletic identity alone, with the AIMS remaining the most widely used tool (24, 25). Chinese scholars have also developed scales based on AIMS to assess athletic role identity within the Chinese cultural context. Yin Hengchan et al. (26) constructed scales encompassing dimensions such as self-identity, positive affect, negative affect, social identity, and behavioral exclusivity. However, these localized tools primarily address the singular dimension of athletic identity without fully integrating the dual role of academic and athletic identities. As the AAIS gained wide recognition, Wu et al. (27) extracted the athletic identity dimension from the AAIS, comprising six items, and used it independently to measure student-athletes identity. However, using only part of the scale may omit other important dimensions of identity, potentially compromising the overall measurement validity and leading to inaccurate or unstable results.

Academic and athletic identities are significantly shaped by sociocultural expectations, which vary across different regions. Formal systems have been established in countries like Australia, Canada, and the United States to recognize and support student-athletes in balancing their academic and athletic commitments (28, 29). In contrast, regions such as Africa, Asia, and Europe present diverse pathways for elite athletes to pursue dual careers, ranging from flexible academic schedules and financial support to individually negotiated agreements (30).

These varying approaches reflect the influence of societal context on student-athletes experiences, creating different opportunities for academic and sports success. This cultural and policy variation emphasizes the need for an assessment tool that comprehensively captures academic and athletic identities within these unique contexts.

Furthermore, research has indicated significant differences in identity recognition between male and female athletes, which may be attributed to gender roles, societal expectations, and psychological and behavioral patterns in sports participation (31, 32). Traditional gender norms in China may further influence how male and female student-athletes navigate their dual identities, making it crucial to examine whether the AAIS-C functions equivalently across genders (33, 34). Therefore, conducting measurement invariance analysis regarding identity recognition across different genders is essential.

This study aims to translate the AAIS into Chinese and assess its reliability and validity among Chinese university athletes using confirmatory factor analysis. Additionally, the study will investigate the measurement invariance of the AAIS across gender groups to confirm its applicability within the Chinese cultural context. This research seeks to deepen the understanding of dual identities in Chinese student-athletes by providing a new measurement tool and perspective. The successful localization and validation of the AAIS will enhance identity research in China and offer valuable insights for cross-cultural studies on student-athlete identities.

MATERIALS AND METHODS

Participants. The study included participants who met the following criteria: i) members of university sports teams who regularly participated in team-organized training and competitions; ii) holders of a national second-level or higher sports certification issued by Chinese sports authorities. A total of 464 eligible athletes were included in the study. The mean age of the participants was 20 years (SD = 1.62), with 297 males (64%) and 167 females (36%). On average, these athletes trained for 11 hours per week (SD = 6.14). The participants took part in various sports, which were divided into team sports and individual sports. Team sports, including basketball,

volleyball, and soccer, had 232 participants, making up 50%. Individual sports, such as badminton, table tennis, tennis, aerobics, track and field, martial arts, taekwondo, and dragon and lion dance, also accounted for 232 participants, representing 50%.

Measures. The Academic and Athletic Identity Scale (AAIS), initially developed by Yukhymenko-Lescroart (19) to assess student-athlete identity, consists of 11 items divided into two subscales: a 5-item academic identity subscale and a 6-item athletic identity subscale. Participants responded: "How important are the following attributes to your sense of self?" Using a 6-point Likert scale, ranging from 1 (not central to my sense of self) to 6 (very central to my sense of self). The Chinese version of the AAIS (AAIS-C) was translated from the original English version following standard translation and back-translation procedures to ensure linguistic and conceptual equivalence.

In addition to the AAIS-C, demographic and sports-related information, including gender, age, BMI, and weekly training hours, were collected to understand the participants' profiles comprehensively.

Ethics and Procedures. We contacted the original author of the AAIS via email and obtained permission to use it. Before data collection, this study was approved by the Human Research Ethics Committee of Universiti Sains Malaysia (USM/JEPeM/KK/23030250). The Chinese translation of the AAIS strictly followed a rigorous translation-back translation procedure to ensure cross-linguistic equivalence (35). First, two bilingual doctoral researchers participated in the translation process. A researcher with a doctorate in linguistics and a background in English education translated the original English questionnaire into Chinese. Independently, a researcher with a doctorate in sports psychology back-translated the Chinese version into English without consulting the first translator. Five experts with a background in sports psychology were invited to assess the validity of the questionnaire's content. Based on their feedback, no significant differences were found between the original and back-translated English versions, and a preliminary Chinese version of the AAIS was created.

Subsequently, the questionnaire was pilot-tested with 10 university student-athletes to evaluate its comprehensibility and usability. The final Chinese version of the AAIS was then developed for use in the study.

Data Collection. This study employed convenience sampling and distributed questionnaires both online and offline. For the offline distribution, we visited several universities in Zhengzhou city in Henan province, where we explained the study's purpose and procedures to university sports teams. Athletes were invited to voluntarily participate during their scheduled training breaks, which was convenient for them without disrupting their regular training. To ensure a diverse sample, we included athletes from different sports disciplines, such as basketball, football, and track and field. Athletes who agreed to complete the paper-based questionnaires were considered to have consented to participate in the study. We used the Sojump platform to create an electronic questionnaire version for online distribution. The questionnaire link and posters were shared through the coaches' QQ groups and WeChat groups. We asked the coaches to thoroughly explain the study to their teams to ensure that the athletes fully understood the purpose and procedures before inviting them to participate and complete the electronic questionnaire. The online version was also distributed to athletes from a broader range of universities to ensure diversity in the sample. On the first page of the electronic questionnaire, we included the informed consent form and explicitly stated that individuals who had already completed the paper-based questionnaire should not participate in the online survey again.

Statistical Analysis. The study was conducted using SPSS 27.0 and Mplus 8.0 for statistical analysis. The data were checked for missing values before analysis, and the multivariate normality assumption test was performed, which showed Mardia multivariate skewness ($p < 0.001$) and kurtosis ($p < 0.001$), indicating that the data did not meet the normality assumption. Therefore, we used MLR to evaluate the validated factor analysis (36, 37).

When assessing model fit, researchers often use multiple fit indices, and the following recommended fit indices and cutoff values were used: root mean square error of approximation (RMSEA) less than 0.07, standardized root mean square residual (SRMR) less than 0.08, and comparative fit index (CFI) or Tucker and lewis index (TLI) greater than or equal to 0.92. High standardized factor loadings (>0.40) are preferred

for item analysis (38, 39) to obtain a good psychometric profile. Convergent and discriminant validity were used to assess the structural validity of the Chinese version of AAIS. Convergent validity was assessed using composite reliability (CR) and average variance extracted (AVE), CR ≥ 0.6, and AVE ≥ 0.5 (40, 41). Discriminant validity can be established when the correlation coefficients between factors are sufficiently low, typically ≤ 0.85 (36, 41).

A multi-group confirmatory factor analysis (MG-CFA) was conducted to examine the measurement invariance of the AAIS-C across gender in university athletes. Firstly, configural invariance is evaluated by fitting the model across groups, allowing factor loadings, intercepts, and other parameters to vary freely. Satisfactory fit indices confirm the presence of configural invariance. Secondly, Metric invariance is assessed by constraining factor loadings to equality across groups, and model comparison is performed using chi-square difference tests or fit indices such as CFI and RMSEA. Following this, intercept invariance is tested by further constraining intercepts while keeping factor loadings invariant, with model fit compared to evaluate invariance. Lastly, residual invariance is tested by constraining residual variances to be equal across groups, providing additional model validation. In this study, ΔCFI and ΔTLI were employed to assess measurement invariance, with the model considered acceptable if ΔCFI ≤ 0.01, ΔTLI ≤ 0.01, and ΔRMSEA < 0.015 were met, as per established criteria (42-45).

RESULTS

Characteristics of Participants. The average age of the participants was 20 years (SD = 1.62), with a mean Body Mass Index (BMI) of 21.8 (SD = 3.72). On average, they engaged in 11 hours of training per week (SD = 6.14). Further descriptive statistics are provided in Table 1.

Table 1. Sample characteristics distribution by gender, grade, and sport level.

Variables	Type	*n*	%
Gender	Male	297	64
	Female	167	36
Grade	First Year	120	26
	Second Year	199	43
	Third year	79	17
	Fourth-year	43	9
	Graduate Students	23	5
Sports level	National First-Class	55	12
	National Second-Class	409	88

Measurement Model of AAIS-C. The original AAIS scale consists of 11 items with 2 dimensions, academic identity and athletic identity, and the Chinese version of the model showed good fit indices in the present data: CFI = 0.978, TLI = 0 972, SRMR = 0.023, and RMSEA (90% CI) = 0.051 (0.038, 0.065) as shown in Table 2.

Table 2. Model fit indices for AAIS-C.

Model	CFI	TLI	SRMR	RMSEA
AAIS-C	0.978	0.972	0.023	0.051 (0.038, 0.065)

CFI: Comparative Fit Index; TLI: Tucker-Lewis Index; SRMR: Standardized Root Mean Square Residual; RMSEA: Root Mean Square Error of Approximation.

Table 3 demonstrates that all standardized factor loadings in the AAIS-C model exceed the 0.7 threshold, indicating that the observed indicators firmly explain the latent variables. Moreover, the correlation coefficient between academic identity and athletic identity is -0.246, indicating a low correlation and a moderate negative relationship between the two constructs, which supports their discriminant validity.

Reliability and Validity. The composite reliability (CR) and average variance extracted (AVE) for the AAIS-C model confirm the strength and reliability of the measurement (see

Table 3). The academic identity shows a CR of 0.895 and an AVE of 0.631, while the athletic identity demonstrates a CR of 0.915 and an AVE of 0.641, both exceeding the recommended thresholds of 0.6 and 0.5, respectively, indicating high internal consistency and convergent validity. Cronbach's alpha for academic identity is 0.895, for athletic identity is 0.914, and the overall alpha is 0.737, further supporting the good reliability and validity of the scale. These results collectively suggest that the model is reliable and valid in assessing academic and athletic identity constructs.

Measurement Invariance. Table 4 presents the results of the measurement invariance tests of the AAIS-C across gender. The configural invariance model (M1) demonstrated a good fit with χ^2(df) = 136.750 (86), CFI = 0.980, TLI = 0.974, SRMR = 0.030, and RMSEA = 0.050, indicating that the underlying factor structure is consistent across genders. The metric invariance model (M2) showed minimal changes in fit indices (ΔCFI = 0.001, ΔTLI = 0.004, ΔRMSEA = -0.003), supporting the equality of factor loadings between male and female groups. However, the scalar invariance model (M3) decreased fit indices (ΔCFI = 0.002, ΔTLI = 0.004, ΔRMSEA = -0.005), suggesting differences in item intercepts across gender groups. The strict invariance model (M4) indicated that residual variances are equivalent across genders, with ΔCFI = 0.004, ΔTLI = 0.005, and ΔRMSEA = -0.007. Overall, the results support configural, metric, scalar, and strict invariance.

Table 3. Standardized factor loading, CR, and AVE of AAIS-C.

Factors and Items	Standardized factor loading	CR	AVE
AD			
Q1	0.802	0.895	0.631
Q2	0.794		
Q3	0.814		
Q4	0.784		
Q5	0.788		
AT			
Q6	0.860	0.915	0.641
Q7	0.807		
Q8	0.804		
Q9	0.766		
Q10	0.777		
Q11	0.788		

AD: Academic identity; AT: Athletic identity; CR: Composite reliability; AVE: Average variance extracted.

Table 4. Baseline model fit results and gender invariance tests for AAIS-C.

Model	χ^2 (df)	CFI	TLI	SRMR	RMSEA (90% CI)	Comparisons	ΔCFI	ΔTLI	ΔRMSEA
M1. Configural	136.750 (86)	0.980	0.974	0.030	0.050 (0.034, 0.066)				
M2. Metric	142.936 (95)	0.981	0.978	0.051	0.047 (0.030, 0.062)	M2-M1	0.001	0.004	-0.003
M3. Scalar	147.538 (104)	0.983	0.982	0.050	0.042 (0.025, 0.057)	M3-M2	0.002	0.004	-0.005
M4. Strict	148.440 (115)	0.987	0.987	0.066	0.035 (0.015, 0.051)	M4-M3	0.004	0.005	-0.007

χ2: Chi-square goodness of fit; df: Degrees of freedom; CFI: Comparative fit index; TLI: Tucker–Lewis index; RMSEA: Root mean square error of approximation; 90% CI: 90% confidence intervals; ΔCFI: CFI difference; ΔTLI: TLI difference; ΔRMSEA: RMSEA difference.

DISCUSSION

This study aims to assess the applicability and reliability of the Chinese version of the AAIS among Chinese university student-athletes through confirmatory factor analysis (CFA) and multi-group confirmatory factor analysis (MG-CFA). The results indicate that the AAIS-C exhibits strong structural validity, convergent validity, and discriminant validity, further supporting its reliability and validity in the

Chinese cultural context. Additionally, the measurement invariance across different gender groups was confirmed, indicating good consistency of the scale in assessing both male and female athletes.

The findings support the two-factor structure of the AAIS-C, consisting of academic and athletic identities. This result aligns with previous validation studies of the original AAIS conducted in different cultural contexts (19, 20), demonstrating the scale's robust cross-cultural applicability. Specifically, all factor loadings exceeded 0.7, with the highest reaching 0.87, indicating that each item had strong explanatory power for the latent constructs. The composite reliability (CR) and average variance extracted (AVE) for academic identity (CR = 0.895, AVE = 0.631) and athletic identity (CR = 0.915, AVE = 0.641) both surpassed the recommended thresholds, providing further evidence of the scale's convergent validity (38, 41). Additionally, the scale exhibited excellent internal consistency, with Cronbach's alpha values of 0.895 for academic identity, 0.914 for athletic identity, and an overall alpha of 0.737, indicating strong reliability.

The study found a negative correlation between academic and athletic identity (r = -0.246), contrasting with findings from studies conducted in Western contexts. Research in Western cultures generally suggests that university student-athletes often receive structured institutional support, such as sports scholarships, flexible academic schedules, and dual-career development programs, facilitating a more harmonious integration of academic and athletic roles (29, 30). In contrast, in non-Western cultures, particularly in China, the conflict between these two identities appears more pronounced. The strong emphasis on academic achievement in Chinese society often leads student-athletes to prioritize academic responsibilities over athletic commitments, which weakens their identification with the athletic role (33, 46). This cultural difference likely explains the negative correlation between academic and athletic identities in this study, highlighting the role of societal expectations and academic pressure in shaping identity conflict among Chinese university student-athletes. These findings underscore cultural context's influence on dual identity formation and highlight the structural and policy-related barriers that contribute to student-athlete identity conflict.

This study systematically evaluated the measurement invariance of the AAIS-C across genders, demonstrating strong cross-gender applicability. The configural invariance test confirmed that the scale's factor structure remained consistent across male and female groups, indicating that the underlying structure of the AAIS-C is stable across genders. The metric invariance analysis further supported the equality of factor loadings, suggesting that both male and female respondents interpreted the items similarly, enabling valid comparisons of factor loadings between genders. However, the scalar invariance test revealed a slight decrease in model fit, indicating potential differences in item intercepts, possibly due to sociocultural factors or variations in athletic experience. As such, caution should be exercised when comparing intercepts across genders. Lastly, the strict invariance test demonstrated equivalent residual variances across gender groups, reinforcing the consistency of measurement error and confirming the scale's stability in cross-gender applications. Overall, these findings validate the AAIS-C as a reliable tool for assessing athlete identity across genders, though further research is needed to explore potential gender-specific differences.

Although this study provides strong support for the cross-cultural applicability of the AAIS, several limitations must be acknowledged. Firstly, the cross-sectional design limits the ability to capture the dynamic changes in academic and athletic identities over time. Future research should employ longitudinal designs to examine how student-athletes identity evolves throughout the academic year or competitive season. Secondly, convenience sampling facilitates data collection but may introduce sampling bias, particularly regarding the geographic concentration of participants in Zhengzhou, Henan province. This could limit the generalizability of our findings to student-athletes from other regions with different academic and athletic contexts.

Additionally, the self-reported nature of the survey may be subject to social desirability bias. Future research could incorporate other data collection methods, such as objective academic and athletic performance measures, to mitigate potential biases associated with self-reporting.

Lastly, while this study confirmed measurement invariance across genders, future research should explore the impact of other variables, such as athletic level and academic discipline, on identifying academic and athletic roles.

CONCLUSION

The Chinese version of the Academic and Athletic Identity Scale (AAIS-C) has demonstrated strong validity and reliability in assessing academic and athletic identities among Chinese university student-athletes. This instrument provides educators, coaches, and psychologists with a comprehensive and robust tool to evaluate student-athletes identities across both domains. By using the AAIS, they can gain valuable insights into key dimensions of student-athletes identities, enabling them to offer more targeted support and enhance their impact on athletes' overall development. Future research could further explore the relationship between student-athletes' self-identity and their behavior patterns, preferences, life choices, achievements, and academic and athletic performance. Furthermore, the AAIS-C establishes a solid theoretical foundation for developing targeted interventions and providing customized psychological support in future research and applied settings.

APPLICABLE REMARKS

- This study demonstrates that the AAIS-C possesses robust reliability and validity for measuring Chinese university student-athletes academic and athletic identities.
- The AAIS-C consists of two factors (academic identity and athletic identity) and 11 items, and it is recommended as a reliable tool for evaluating the dual identities of student-athletes in Chinese cultural contexts.

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AUTHORS' CONTRIBUTIONS

Study concept and design: Xiawei Wang, Garry Kuan. Acquisition of data: Xiawei Wang, Weipeng Duan, Liliana Puspa Sari. Analysis and interpretation of data: Xiawei Wang, Lan Li, Yee Cheng Kueh. Drafting of the manuscript: Xiawei Wang. Critical revision of the manuscript for important intellectual content: Lan Li, Garry Kuan, Yee Cheng Kueh. Statistical analysis: Xiawei Wang, Yee Cheng Kueh. Administrative, technical, and material support: Weipeng Duan, Lan Li, Liliana Puspa Sari. Study supervision: Yee Cheng Kueh, Garry Kuan.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

FINANCIAL DISCLOSURE

This study has no financial interests related to the material in the manuscript.

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ETHICAL CONSIDERATION

This study was approved by the Human Research Ethics Committee of Universiti Sains Malaysia (USM/JEPeM/KK/23030250). The study adhered to the principles outlined in the Declaration of Helsinki, and written informed consent was obtained from all participants.

ROLE OF THE SPONSOR

No sponsor.

ARTIFICIAL INTELLIGENCE (AI) USE

There was no use of artificial intelligence for preparation, writing, or editing this manuscript.

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