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## Evaluation and test of the reliability and validity of the Chinese defeat scale in the elite athletes of Chinese universities

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To test the reliability and validity of the “Defeat Scale” and explore whether the scale is suitable for use in surveys of college athletes. A total of 226 athletes from five universities in China were selected for evaluation using the defeat scale. Factor analysis and correlation analysis were used to explore the reliability and validity of the defeat scale. Exploratory factor analysis showed that two factors could be extracted from this scale, namely a sense of decadence and a sense of low achievement. Confirmatory factor analysis showed that the model fit of the two factors was excellent ( $\chi^2/DF=2.809$ ,  $RMSEA=0.092$ ,  $SRMR=0.054$ ,  $NFI=0.891$ ,  $IFI=0.927$ ,  $CFI=0.926$ ,  $GFI=0.919$ ,  $TLI=0.910$ ). The convergent validity AVE values are 0.579 and 0.505 respectively,  $AVE > 0.5$ , and the combined reliability is 0.946 and 0.746 respectively. Both  $> 0.7$  indicate good convergence effect. The arithmetic square roots of AVE, 0.760 and 0.710, are both higher than the absolute value of the correlation coefficient between the two dimensions, 0.30, indicating good discriminant validity; and the Cronbach’s alpha coefficient of defeat is 0.931, and the Spearman-Brown coefficient is 0.888. The defeat scale has good reliability and validity among college athletes.

**Keywords** Defeat, Colleges and universities, Athlete, Reliability, Validity

According to the report “China’s National Mental Health Development Report (2021–2022)”, the detection rate of depression risk in the 18–24 age group in China is as high as 24.1 per cent<sup>1</sup>. This condition not only affects the daily life of adolescents, but also may increase their risk of developing related psychiatric disorders in adulthood<sup>2</sup>. Athletes, as a special group in the society, although they show sunshine and vitality on the surface, they also face the challenge of mental health. They often bear the pressure of self-denial and carry a heavy psychological burden<sup>3</sup>. Studies have shown that suicide rates are higher among athletes compared to the general population, and that depression and suicide due to psychological problems are increasing globally<sup>4</sup>. A 20-year analysis of athlete suicide rates conducted by the NCAA showed that the percentage of deaths by suicide doubled between the first and last decade<sup>5</sup>. In China, where athletes are imbued with a strong culture of “competing for the glory of the country”, athletes’ defeats are rooted in the desire to excel in their sport, the difficulty of further improving their technical skills, and the pain of injuries and illnesses<sup>6</sup>. This defeat is closely linked to the daily training and life demands of athletes, including meeting personal and others’ expectations, coping with the intensity of training competitions, dealing with physical and mental stress, maintaining relationships, injury rehabilitation, and dealing with the intense attention of spectators and fans<sup>7</sup>. Research by Thomas Joyner, a professor of psychology at Florida State University, reveals that athletes’ passivation of pain may have taught them “how to hurt themselves,”<sup>8</sup> which makes the issue of depression and suicide in athletes often overlooked. With the popularity of social media and new media, more and more athletes’ mental health problems have been concerned by the public. For example, Michael Phelps was one of the first athletes to publicly struggle with anxiety and depression<sup>9</sup>, and cases like Chinese Go player Fan Yunruo, who died in 2020 after falling from a building in a depression<sup>10</sup>, all highlight the importance of athletes’ mental health.

Defeat, as a potential warning signal for depression, is significantly predictive<sup>11</sup>. Given the influence of cultural context on the experience and expression of individual defeat, it is necessary to revisit and evaluate the psychometric properties of defeat scales in a Chinese cultural context. The stress and challenges that athletes suffer in competitive sports are enormous, and these pressures and challenges may have profound effects on their mental

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health and competitive performance<sup>12</sup>. As a big sports country, China has attached great importance to the mental health and competitive state of its athletes. Localizing improvements to the DS scale by examining psychometric properties can ensure the accuracy and validity of the scale, allowing better assessment and understanding of athletes' mental states and helping them cope with defeat and other psychological problems.

## Literature review

Defeat, the origins of the concept can be traced back to the evolutionary theory of depression proposed by Price<sup>13</sup>, which originates from the description of human depression in social hierarchy, specifically to the psychological state felt by individuals in the decrease or loss of social hierarchy after failure in social competition<sup>14</sup>. The social hierarchy theory of depression proposed by Wetherall (2019) provides us with a framework to deeply explore the interaction between social hierarchy and mental health<sup>15</sup>, and the studies of Price (1972) and Stevens (2000) provide important support for this theory<sup>16,17</sup>. From an evolutionary perspective, it is found that after animals fail in social competition, they will adopt a series of short-term self-protection strategies, such as reducing social activity, increasing sleep and feeding, and excessive vigilance<sup>18</sup>. These behaviors are an adaptive response of an animal to a dangerous environment, known as the involuntary failure syndrome and designed to avoid further harm<sup>19</sup>. Similarly, the concept of defeat has been extended into the human realm. In resource competition, competition, and conflict in human society, some individuals will face failure and defeat, which may lead them to submit to the behaviors, such as withdrawal, submission, or abandonment<sup>20</sup>. These behaviors, manifested at the psychological level, as low self-esteem, compliance and self-criticism, are important features of depressive states<sup>21</sup>, and understanding this will help us to better understand the development of mood disorders such as depression as well as suicidal behaviors<sup>22</sup>. A systematic review and meta-analysis found that the concept of frustrated social class was strongly associated with depressive symptoms in both clinical and non-clinical samples<sup>23</sup>. Therefore, the researchers proposed three forms of scale development: the development of new scales, the adoption of scales similar to concepts, and the evaluation of the psychometric properties of existing scales<sup>24</sup>. This study selected the third method based on the generality and replicability of the scale.

As a factor that has a profound impact on an individual's physical and mental health, defeat has received a lot of attention in recent years. Four specific measurement tools have been developed to address this phenomenon, Gilbert proposed Defeat Scale (DS)<sup>25</sup> in 1998, Griffith designed Short defeat and entrapment scale (SDES)<sup>26</sup> in 2015, and Sturman The Defeat, Victory and Acceptance Scale (DVAS)<sup>27</sup> constructed in 2019 based on the Modified Life Experience Survey (LES) and the Psychological defeat Scale constructed by Aldawsari in 2024, Psychological Defeat Scale (PDS)<sup>28</sup>. The Defeat Scale (DS) scale with good reliability and validity was used for this study, is mainly based on the following reasons: First, the DS scale was developed by Gilbert and Allan in 1998 based on the theory of social hierarchy, which theoretical basis ensures the scientific nature of the study. Second, since 1998, the scale has been tested for its reliability and validity in Turkey, Germany and other countries<sup>29,30</sup>, Demonstrated its reliability and validity in different groups and different cultural backgrounds, becoming a widely recognized and trusted research tool, providing a solid empirical basis for this study. Furthermore, the DS scale is supported by extensive literature, with the most cited scale in the DS scale compared to other scales. Finally, the DS scale of operation is one of the important reasons as a research tool, compared with the complex structure of other scales, DS scale only contains decadent feeling and low achievement two dimensions, 16 items, researchers generally believe that the shorter scale in ensuring reliability at the same time, also more practical, more easy to be cited and adopted<sup>24</sup>.

Current research on defeat in Chinese academia includes only a few validation studies on the influencing factors of defeat and the relationship between the variables in a certain group of Chinese people, and there are no detailed studies on the theoretical concept of defeat<sup>31–33</sup>. The literature on the field of athlete defeat is still blank. Even though the original model has a clear conceptual framework, it is possible that the scale may be revised or adjusted over time and with application in different groups. This study first conducted an EFA to explore whether the structure of the DS scale is consistent with the original model in a new group of elite college athletes in the context of Chinese culture, which can help to identify which items are no longer closely associated with the expected factors, thus providing a Rationale. Secondly, the reliability and validity of the scale was measured by CFA. Aiming to provide researchers with an empirically tested defeat scale applicable to the Chinese athlete population, which not only helps to reveal in depth the real conditions and needs of athletes in abnormal psychological states, but also has a positive significance in reducing the occurrence of risky events such as depression and suicide. In the follow-up work, the scale will provide athletes with more accurate mental health services and interventions, effectively assisting them to cope with and solve their psychological problems in a timely manner.

## Method

### Participants and procedure

In the scale method study, EFA needs to meet the following three requirements: a sample number must be greater than the number of variables; b must have at least 150 samples; c sample size must be 5 times the number of items in the scale, and CFA requires the sample size to be at least 10 times of the items<sup>34,35</sup>. The scale used in this study has 16 items in total, 226 participants were actually included, meeting the minimum sample size requirement. A convenience sampling method was used to conduct a survey on sports athletes from Renmin University of China and Hebei University of Technology in November 2023, involving national athletes, national first-level athletes, national second-level athletes, and national third-level athletes. A total of 226 questionnaires were issued and returned. There were 216 valid questionnaires, with an effective rate of 95.57%. The respondents were between 18 and 22 years old, including 153 male athletes and 63 female athletes; 6 national elite athletes, 39 national first-class athletes, 79 national second-class athletes and 92 national third-level athletes; 80 only children and 136 non-only children; 91 urban residents and 125 rural residents.

This study was approved by the Academic Committee of Cangzhou Jiaotong College, and all methods were conducted in accordance with psychology-related guidelines and regulations. It was collected through online questionnaires from five universities including Renmin University of China and Hebei University of Technology. In order to ensure the authenticity of the questionnaire answers, before the survey, we contacted the coaches of each university and obtained the approval and approval of the sample collection from the school. Approval, the coach will explain the purpose, process and significance of this study to the respondents in detail, and answer all their questions. After confirming that the informed consent of all subjects has been obtained, the coach will answer the questions in a closed and quiet room. Supervision is complete.

## Measures

The defeat Scale was proposed by Gilbert and Allan in 1998 to quantify the feeling of defeat caused by loss of social status, wealth, resources and struggle<sup>25</sup>. The defeat scale has 16 items, which entries 2, 4, and 9 are scored in reverse, while the rest are scored in forward. The 5-point scoring method is adopted: 0–4 points are counted in the order of "never", "rarely", "sometimes", "often" and "always", and the total score is calculated after the reverse scoring entries are converted. The total score range is 0–64, and the higher the score, the stronger the defeat.

## Statistical methods

SPSS26.0 and AMOS24.0 software were used to analyze the reliability and validity of the data. Exploratory factor analysis and confirmatory factor analysis were used to verify the structural validity of the defeat scale, the convergence validity was evaluated by mean variance extraction and combination reliability, and the discriminative validity was evaluated by the square comparison method of AVE and correlation coefficient. Internal consistency reliability (Cronbach's  $\alpha$  coefficient) and 50/50 reliability (Spearman-Brown coefficient) were used to test the reliability of the scale.

## Ethical approval

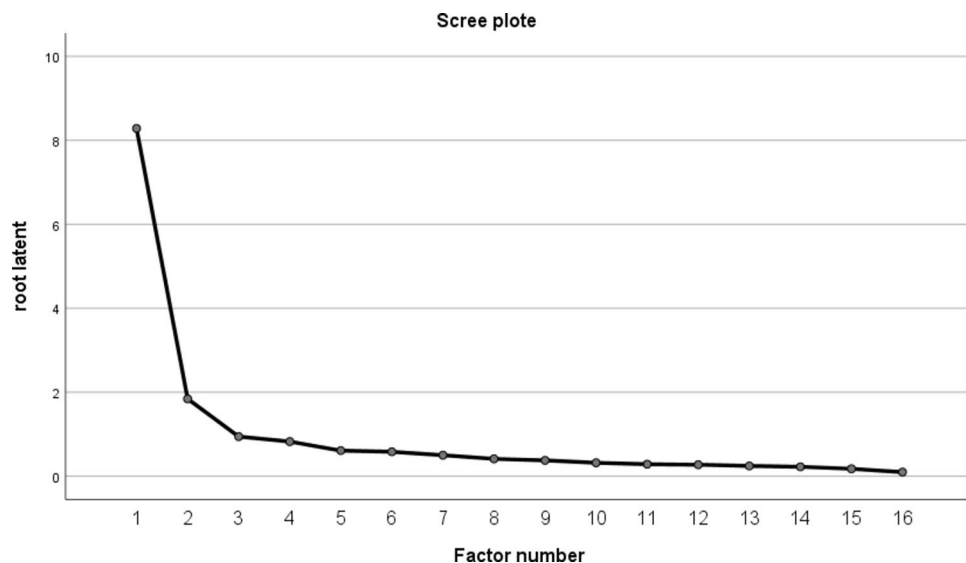
This study is a psychological survey research, not an experimental psychology research. It is based on psychological experimental ethics, follows the general principles of seeking truth from facts, rigor and prudence, and protects the subject's right to informed consent and the confidentiality of survey data.

## Results

### Structural validity

#### *Exploratory factor analysis*

Wu (2009) clearly points out that in the testing of scales or questionnaires, the first step is to perform exploratory factor analysis. The main purpose of the analysis, to explore and determine the potential internal structure of the scale, by reducing the number of items, and form a set of small number but high correlation between each other variables, in order to get the best factor structure, establish the questionnaire construct validity, this factor analysis is a kind of exploratory factor analysis method<sup>36</sup>. Firstly, Determine the feasibility of factor analysis by Kaiser–Meyer–Olkin (KMO) test and Bartlett test; KMO results should be at least above 0.6, preferably above 0.8, and meet  $p$  value (sig)  $< 0.05$ <sup>37</sup>. The results showed that the KMO sampling suitability parameter was 0.944, and the Bartlett sphericity test  $P < 0.05$ , indicating that the data were suitable for factor analysis. Second, the exploratory factor test was performed by PCA, and the factors were extracted with the eigenvalue 1. Figure 1 shows that the curve leveled off after extracting 2 common factors. Two factors were extracted by the maximum orthogonal rotation, respectively named: decadence and low achievement, and the cumulative contribution rate



**Figure 1.** Exploratory factor analysis scree plot of defeat scale. Source(s): Author's own creation.

of variance was 63.293%, indicating that the common factor was reliable and did not need to delete any items in DS<sup>35</sup>. Table 1 shows the standard factor load of each item in the defeat scale. The factor load value of each item is between 0.510 and 0.90, all > 0.5, above the lowest acceptable value<sup>35</sup>; the common value is between 0.466 and 0.825, all > 0.2<sup>34</sup>.

#### Confirmatory factor analysis

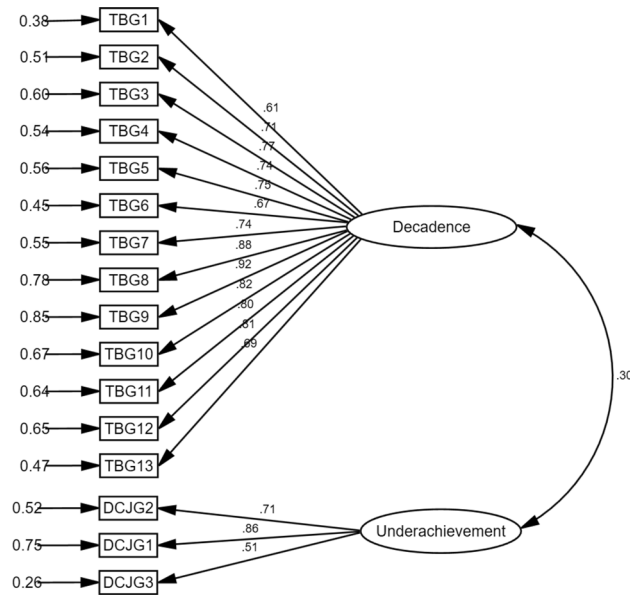
On the basis of exploratory factor analysis, the scale was subjected to validation factor analysis, and the preliminary assessment of the model found that the factor loading values for each entry were between 0.5 and 0.95, and all the parameter values reached the significant level, and the factor loadings were statistically significant ( $P < 0.05$ ), and the preliminary assessment met the criterion<sup>38</sup>. In this study, multiple fitting indicators were used to evaluate the fit of this model with the acceptable values of  $\chi^2/df < 3$ , RMSEA, RM SRMR < 0.08, and NFI, IFI, TLI, CFI, GFI > 0.9<sup>38</sup>. A validated factor analysis of the two-factor model was conducted to assess the model fit, and it was found that the theoretical model did not fit the observed data well enough, as shown in Fig. 2. The model fit values for the defeat Scale before modification were: chi-square degrees of freedom ratio ( $\chi^2/df$ ) = 3.814, > 3; root mean square error of approximation (RMSEA) = 0.114, > 0.08; standardised root mean square residual (SRMR) = 0.062, < 0.08; standardised fit index (NFI) = 0.845, value-added fit index (incremental fit index (IFI) = 0.880, comparative fit index (CFI) = 0.880, goodness of fit index (GFI) = 0.882, Tucker-Lewis Index (TLI) = 0.860, all < 0.9, indicating that the model is underfitted. After correcting the two-factor model with reference to the correction index, the model was fitted again, as shown in Fig. 3, and the results showed an excellent model fit. The corrected model fit values for the defeat scale (Table 2): Chi-square freedom ratio ( $\chi^2/df$ ) = 2.809, < 5; root mean square error of approximation, (RMSEA) = 0.092, close to 0.08; standardized root mean square residual, (SRMR) = 0.054, < 0.080; normed fit index (NFI) = 0.891, incremental fit index (IFI) = 0.927, comparative fit index (CFI) = 0.926, Tucker-Lewis index (TLI) = 0.910, both > 0.900, the model fits well. The hypothetical CFA model can fit with the observed data, and should further check whether the hypothesis model has good convergence validity and discriminative validity<sup>38</sup>.

#### Convergence validity

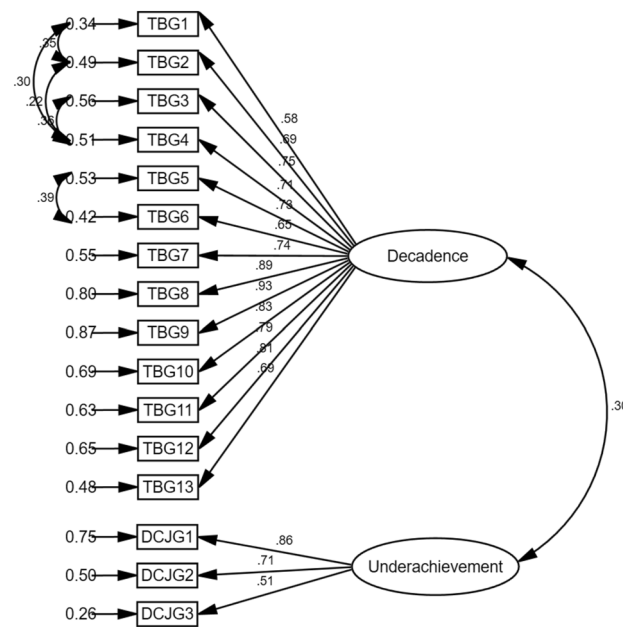
Convergent validity represents the degree of correlation between the indicator variables measured for the same latent trait or construct. The higher the correlation between these measured index variables, the higher the factor load of the index variable on this factor, the better the aggregation validity of the potential constructs reflected by these measurement index variables, based on AVE index and combined reliability index, indicating that the AVE is greater than 0.50 and the combined reliability value is above 0.70<sup>38</sup>. Table 3 reports the convergent validity evaluation index of low accomplishment and decadent dimensions-average variance extraction (average variance extracted, AVE) were 0.579 and 0.505, All met the criteria of AVE > 0.5, This fully proves the good; Combined reliability of the two dimensions (composite reliability, CR) were 0.946 and 0.746, respectively, Show that the measurement model performs equally well in the combined reliability, Combining the above two indicators, It can be concluded that the scale is good.

Item	Factor load	Ingredient		Communality
		Decadence	Underachievement	
1. I feel that I have not made it in life	0.60	0.632		0.825
2. I feel that I am a successful person	0.88	-	0.864	0.765
3. I feel defeated by life	0.69	0.743		0.696
4. I feel that I am basically a winner	0.71	-	0.814	0.678
5. I feel that I have lost my standing in the world	0.72	0.811	-	0.675
6. I feel that life has treated me like a punchbag	0.71	0.792	-	0.660
7. I feel powerless	0.74	0.757	-	0.630
8. I feel that my confidence has been knocked out of me	0.66	0.669	-	0.620
9. I feel able to deal with whatever life throws at me	0.51	-	0.681	0.570
10. I feel that I have sunk to the bottom of the ladder	0.75	0.738	-	0.570
11. I feel completely knocked out of action	0.88	0.868	-	0.505
12. I feel that I am one of lifes losers	0.92	0.903	-	0.560
13. I feel that I have given up	0.82	0.833	-	0.470
14. I feel down and out	0.80	0.815	-	0.760
15. I feel I have lost important battles in life	0.81	0.813	-	0.690
16. I feel that there is no fight left in me	0.69	0.696	-	0.466
Eigenvalue		8.284	1.843	
Variance (%)		51.777	11.517	
Cumulative (%)		51.777	63.293	

**Table 1.** Factor load values of defeat scale. Source(s): Primary data.



**Figure 2.** Pre-modified model of defeat scale. Source(s): Author’s own creation using AMOS. *Note* The two-way arrow indicates the related path, the one-way arrow indicates the causal path, and the values on the path are all factor loads; the oval represents the latent variable, and the rectangle represents the measurable variable; "TBG" stands for Item, and "DCJG" stands for Item.



**Figure 3.** Modified model of defeat scale. Source(s): Author’s own creation using AMOS. *Note* The two-way arrow indicates the related path, the one-way arrow indicates the causal path, and the values on the path are all factor loads; the oval represents the latent variable, and the rectangle represents the measurable variable; "TBG" stands for Item, and "DCJG" stands for Item.

Fitting index	$\chi^2/df$	RMSEA	SRMR	NFI	IFI	TLI	CFI	GFI
Pre-modified	3.814	0.114	0.062	0.845	0.880	0.860	0.880	0.882
Modified	2.809	0.092	0.054	0.891	0.927	0.910	0.926	0.919

**Table 2.** Validation factor analysis of the defeat scale. Source(s): Primary data.

Validity analysis	CR	AVE	MSV	MaxR(H)	Decadence	Under achievement
Decadence	0.946	0.579	0.087	0.961	0.761	
Underachievement	0.746	0.505	0.087	0.812	0.295	0.71

**Table 3.** Convergent validity values of the defeat scale. Source(s): Primary data.

### Discriminative validity

Differentiating validity is a low correlation or significant difference between the latent trait represented by factors or constructs and the latent trait represented by other factors or constructs. The most commonly used test to distinguishing validity is: the square root between AVE and variable correlation coefficient comparison: if the square root of AVE is greater than the correlation coefficient between two variables (or the AVE value of both constructs is greater than the square of two constructs), indicating the good differential validity between the theory explained by a latent construct (measurement variable) should be higher than the variation explained by another latent construct<sup>38</sup>. As shown in Table 4, on the perspective of differential validity of decadence and low accomplishment, the AVE of decadence is 0.579, the arithmetic square root is 0.760, the AVE is 0.505, and the arithmetic square root is 0.710; the correlation coefficient of decadence and low accomplishment is 0.3. The square root of AVE for both factor constructs was higher than the correlation coefficient between the two factor constructs, indicating good discriminatory validity between the two factors.

### Internal consistency reliability and folded half-reliability

As shown in Table 5, the internal consistency reliability is also called the homogeneity reliability, which refers to the degree of consistency among all questions inside the inspection. The Cronbach's  $\alpha$  coefficient is bound between 0 and 1, and the  $\alpha$  0.9 scale reliability is ideal<sup>34</sup>. This study went through an internal consistency testing of each item of the defeat scale, the results show the Cronbach's  $\alpha$  coefficient of the DS scale of 0.931, The Cronbach's  $\alpha$  coefficient of decadence sense dimension and underachievement dimension was 0.947 and 0.723, respectively; Half half reliability (Spearman-Brown coefficient) measures a population, The items in the scale are then divided into two halves of the same number (by parity, or front and back), Then we can find the correlation coefficient of the total score of the two subscales, This coefficient is the folded half-reliability coefficient, A folded half reliability greater than 0.70 means better reliability<sup>39</sup>. In this model, the coefficient of folded half reliability is 0.888, greater than the standard of 0.7. In conclusion, the scale shows good reliability in terms of internal consistency reliability and half reliability.

### Discussion

Compared with the general population, athletes experience more defeat. This phenomenon is closely related to the professional characteristics of athletes, and Chinese athletes are inspired by the Chinese sports spirit of "winning glory for the country, selfless dedication, scientific truth, law-abiding, unity and cooperation, and tenacious stimulate"<sup>40</sup>. They often show a high degree of competition and a desire for victory, and this continued career pursuit may trigger a stronger sense of failure in a highly competitive environment. In order to create a healthy team competition mode, stimulate the training vitality of athletes, improve the training level, and promote the improvement of athletes' performance, long-term intensive training and competition may cause physical and psychological fatigue of athletes<sup>41</sup>, this state may cause their calm emotions to become unbalanced in the event of failure, and they are more likely to feel the loneliness and sadness that comes with defeat<sup>42,43</sup>. In addition, an athlete's career is relatively short, opportunities are precious, and every failure can be seen as a major career setback. At the same time, the image of Chinese athletes on the international stage not only reflects the level of sports competition, but also becomes a carrier of national image and cultural confidence<sup>44</sup>. In the face of the

Factor construct	AVE	Decadence	Under achievement
Decadence	0.579		
Under achievement	0.505	$r = 0.30^{***}$	

**Table 4.** Discriminant validity values of defeat scale. Source(s): Primary data Note: The diagonal line represents the square root of AVE; the lower triangle area is the correlation coefficient between constructs; \*\*\*Indicates that the correlation coefficient is significant at the 0.001 level.

	Total schedule	Decadence	Under achievement
Internal consistency reliability	0.931	0.947	0.723
Spearman-Brown	0.888		

**Table 5.** Reliability coefficient of defeat scale. Source(s): Primary data.

hard work of coaches and the attention of family members and the public, while athletes are filled with inner gratitude, the high expectations that athletes may feel may further magnify the effects of defeat and multiply their inner suffering<sup>45</sup>. May further trigger defeat and psychological burden in individuals, thereby increasing the risk of depression<sup>46</sup>. Therefore, under the social culture and training mechanism of high ethnic complex in China, ensuring a reliable and effective scale to measure athletes' defeat can control a key variable that causes depression and suicide, and finally reduce or alleviate the mental health burden caused by depression on athletes and reduce the occurrence of depression and suicide. Athletes are more likely to experience failure than the general population, which may lead to greater feelings of defeat. This defeat may trigger depression and psychological burden in the individual, thereby increasing the risk of depression.

This paper examines the reliability validity of the DS scale proposed by Gilbert and Allan in 1998. Consistent with the results of previous studies, the scale showed good reliability and validity indicators<sup>47,48</sup>. This study aims to provide a scale of elite Chinese college athletes who can measure their defeat and initially judge their depression status. To ensure the accuracy and reliability of the scale, we selected elite athletes from five universities across the country for reliability and validity analysis.

Validity, also known as validity, is the degree to which a test or scale can actually measure its intended psychological traits<sup>49</sup>. This study used various methods including structural validity, discriminative validity, and convergent validity to comprehensively evaluate the validity of the defeat scale in the elite athlete population in China. In terms of construct validity, an exploratory factor analysis was used. Through this method, it is found that the cumulative variance contribution of the extracted common factor is more than 40%, and the factor load of each item is greater than 0.5, indicating that the actual measurement results of the scale have a good agreement with the theoretical assumption, thus proving that the scale has a good structural validity. In this study, principal component analysis and maximum variance method were used to successfully extract two common factors, respectively, decadence and Underachievement. The load value of each entry was greater than 0.5, and the cumulative variance contribution of these two factors was 63.239%. On the basis of exploratory analysis, we conducted validation factor analysis with AMOS structural equation model software, and finally obtained the revised two-factor DS model (Fig. 1). Convergent validity was evaluated using mean variance extraction and combined reliability, and discriminant validity was evaluated using squared comparison of AVE and correlation coefficients, and the results met the assessment criteria. In the revised model, the fit degree reached the standard of good fit, which further showed that the defeat scale has good structural validity. Reliability is reliability, which refers to the stability and consistency of the questionnaire survey results when the same scale is used for investigating the same population, that is, whether the scale can stably measure certain characteristics of the target population<sup>50</sup>. This study assessed the reliability of the defeat scales used in the athlete population. After analysis, the Cronbach's  $\alpha$  coefficient of the DS scale was 0.931, and the Cronbach's  $\alpha$  coefficients of both dimensions were 0.947 and 0.723, respectively. Moreover, the Spearman-Brown fold coefficient results in 0.888, which indicates the high reliability of this scale. These data further confirm the reliability and stability of this scale in the athlete population.

In summary analysis can see that from the dimensions of the scale theory construct validity, decadent as the core dimension of the defeat scale, can well explain the athletes in the face of failure, injury, retired situation and lose motivation and direction, this is a kind of loss of enthusiasm and confidence in life, feel their life meaningless, this after many failure, may produce acquired helplessness to let a person into a negative emotional state, may even appear depression and suicide thoughts. As the second dimension of the defeat scale, low sense of achievement can explain the psychological state of athletes when they cannot achieve their own goals or fail to play their best level in the competition in terms of self-value affirmation and self-efficacy. It is believed that this scale can objectively provide a measurable tool for the defeat assessment of elite athletes in Chinese universities, and provide a preliminary judgment basis for the subsequent research on psychological problems such as depression in athletes.

### Limitations of the study

There are some limitations in this study, firstly, this study only studied elite athletes at the undergraduate level in five universities in China, it did not include athletes at higher competitive levels and did not cover all sports, due to the differences in training years and competition experience, athletes with higher competitive levels may differ in their feelings and focus on defeat. and secondly, due to the insufficient sample size, it did not use a different samples for independent EFA and CFA, so future research in this study could expand the sample to include different types of athletes as well as athletes from different geographical and cultural backgrounds to test the applicability and validity of the scale. In addition, this study mainly focused on the reliability analysis of the scale, and future studies can further explore the relationship between the defeat scale and other related scales, such as psychological vulnerability and psychological capital, in order to gain an in-depth understanding of the impact of defeat on athletes' psychological state.

### Conclusions

This study tested the reliability and validity of the "Defeat Scale" through exploratory factor analysis and confirmatory factor analysis. The results showed that: the scale includes 16 items in two dimensions: decadence and low sense of achievement. The overall scale the fit is good and the internal consistency is relatively stable, making it suitable for testing elite athletes from Chinese universities. Coaches can use it to understand the mental state of athletes to develop more effective training plans. Psychiatrists can use it to evaluate whether athletes need psychological intervention or evaluate the effect of intervention. It provides a powerful tool for athletes' defeat assessment and psychological problem research, providing a more scientific, systematic and comprehensive foundation and reference for improving or preventing depression.

## Data availability

All data generated or analysed during this study are included in this published article.

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### Author contributions

L.T mainly writes the article, and L.Y.M mainly handles the data.

### Competing interests

The authors declare no competing interests.

### Additional information

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