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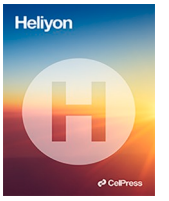

Research article

Development of a scale for the impact of emotion management on young athletes' training efficiency

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ABSTRACT

In this study, we developed a scale to evaluate emotion management and its benefits for young athletes in China, and to analyze the impact of emotion management on their training efficiency. Following an extensive literature review, we used AMOS structural equation model software to develop a scale for evaluating the effects and benefits of emotion management on young athletes' training efficiency. Results showed that young athletes' emotion management training and its benefits can be divided into five dimensions: benefit evaluation, emotional cognition, emotion influence, emotion control, and emotion regulation. The internal consistency reliability of the formal scale was 0.895, and the internal consistency reliability of each subscale was between 0.734 and 0.901. The split-half reliability was 0.769, and the split-half reliability of each subscale was between 0.623 and 0.864. The KMO value was 0.904, P = 0.00 ($p < 0.05$), and the cumulative interpretation rate was 61.782 % of the total variance. The lowest factor load of a scale item was 0.436, and the highest factor load was 0.846. The common degree of all items was between 0.402 and 0.762, indicating that the scale has good validity. A SEM model verified that the scale has good construct validity. Significant correlational differences were observed among the levels. The results of the SEM structural equation model analysis showed that the model's NC = 2.660 ($1 < NC < 3$ indicates that the model has a simple fit), PGFI = 0.722, PNFI = 0.699, IFI = 0.851, PRA = 0.927, RMR = 0.006, and RMSEA = 0.07, thus, these indexes reached the standard of excellent model fitting. The strongest correlation was found between emotional cognition and benefit evaluation (R = 0.690), and the weakest correlation was found between emotion influence and benefit evaluation (R = 0.079). These findings provide a basis for measuring the effect of emotion management on training efficiency in the training process of young athletes and offer a theoretical reference for their emotional development while in training.

1. Introduction

Emotion is the corresponding behavioral response of people to objective things, which is mediated by individual needs and wishes, including subjective experience, external performance, and physiological awakening. Joy, anger, sadness, and happiness are all manifestations of emotions. Currently, research on the emotion management of young athletes mainly focuses on their emotion regulation and control during competitions [1]. No in-depth empirical research has been conducted on the emotion management and

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development of athletes in the training process. Scholars outside of China have conducted a variety of empirical studies, such as emotional intelligence and emotional and best dysfunctional motor performance [2,3]. The perceptual influence of emotion on attention concentration and performance during exercise has shown that the best exercise performances are related to changes in emotional state [4–6]. Young athletes have developed rapidly in emotion control and regulation For them [7,8],psychological development is uncertain, and the fluctuation of emotions is large and unstable [9]. Once a disruptive emotion occurs, it can affect even more than daily training. Ultimately, a lack of science-backed and effective management will affect the athletes' performance, and even damage their social growth and mental health. Therefore, it is essential to study the emotion management that occurs during young athletes' training process. The findings of the present study verify which aspects of emotion management have a significant impact on the evaluation of benefits to young athletes [10–13,]. This was accomplished through the development of an emotion management and sports growth scale for young athletes [14,15], to provide scientifically founded interventions and to guide the development of their emotions in their daily training process.

Scholars from different countries have conducted a large amount of research on emotional management from different perspectives, which has mainly covered emotional management methods and functions. Some notable research results have been achieved. For example, Wang Xiaochen [16] discussed the effects of emotional management process and summarized these effects as affinity effect, emotional effect, and complementary effect, among others. Wang Quanquan [17]explained the connotations of college students' emotional management and offered suggestions on how emotional management courses could be conducted as part of broader college courses. Klaus R et al. [18] used the rapid test method of emotion recognition ability (i.e., the Emotion Recognition Index) to confirm the correlation between emotion recognition ability and career development.

Most research on young athletes' emotional management has focused on emotional regulation during and after competition, which also achieved certain research results. For example, Lane [19] and Oliveira [20] verified the impact of emotional management disorders on the best athletic performance. The results reported by Vast et al. [21] showed that the level of emotional management ability in sports directly affected athletes' concentration level. Another study [22]confirmed that the best performance of exercise was highly correlated with the change of emotional state. A comprehensive analysis of previous research results showed that available research has not included in-depth empirical studies on the emotional management and construction of athletes in the training process. Only by performing emotional management before the training can the effective regulation of the athlete's own emotional management ability in competition be ensured, meaning they can achieve the ideal sports performance.

Therefore, the main purpose of this study was to construct a scale to examine the impact of adolescent athletes' emotional management on training effectiveness, identify the major factors affecting athletes' emotional management, and offer suggestions for the application of emotional management in this context. Our research questions were as follows.

1. What are the dimensions of the scale of the impact of adolescent athletes' emotional management on training effectiveness?
2. What factors of emotional management have the greatest impact on the training effectiveness of young athletes?

2. Materials and methods

2.1. Research participants

Participants comprised 431 students from middle schools and universities in Chongqing, China: Chongqing Sports Technology School, Tianjin First-line Sports Team, Beijing Sport University, and Shandong Institute of Physical Education; students from some universities in Shaanxi Province were also included. Of these, 223 were boys and 208 were girls (age range: 13–19); 21 were national masters athletes, 47 were first-grade athletes, 108 were second-grade athletes, and 255 were third-grade athletes or below. Sport specialties represented in the sample were: basketball, football, volleyball, table tennis, badminton, tennis, track and field, swimming, martial arts, sports dance, taekwondo, weightlifting.

2.2. Ethical consideration

The research received ethical approval from the Sports Science Experiment Ethics Committee of Beijing Sport University. under reference number 2023099H. Informed consent was sought before participant recruitment by the researcher. The employees were made aware that participation was completely optional and that they had the option of agreeing or declining.

2.3. Literature method

Accessing EBSCO, Web of Science and CNKI resource databases, we downloaded and consulted many domestic and foreign literatures, including 97 master's and doctoral dissertations. The main search terms were: "emotion management," "athlete emotion," and "benefit evaluation." Additionally, we reviewed sports psychology, psychology, and other related publications, which provided a rich theoretical reference for this study.

2.4. Questionnaire survey

The scale developed in this study was designed using a 5-point Likert-type scoring method, with a range from "completely inconsistent" (1) to "completely consistent" (5); some items were reverse scored. A total of 610 questionnaires were issued, 455 were

completed, 431 of which were valid. Thus, the recovery rate was 74.59 %, and the effective recovery rate was 70.66 %.

2.5. Mathematical statistics

The collected data were processed and analyzed using SPSS 22.0 and SPSS Amos 24.0 statistical software. Principal component factor analysis with Promax rotation was used to examine the factor structure of the questionnaire. To determine the internal reliability, Pearson correlation coefficients were used to examine the concurrent and convergent validity. Differences between the mean values for two or more groups were evaluated independent sample *t*-test or a one-way analysis of variance (ANOVA) with Bonferroni correction. $P < 0.05$ indicated a statistically significant difference.

An exploratory factor analysis (EFA) with a varimax rotation was used to examine the variable/concept structure. The number of factors was based on eigenvalues larger than one. The dimensions underlying the observed variables were also examined using confirmatory factor analysis. The CFA was based on the maximum likelihood estimation procedure and correlation matrix of the items measuring the concepts. Cronbach's (1951) alpha and McDonald's (1999) omega reliability coefficients were also computed for each set of items comprising the scales. A reliability coefficient of 0.75 or above was considered acceptable. Structural equation path analyses were used to test the predictive validity of model.

3. Scale development procedure

The scale development procedure consists of three stages. The first stage involves the preliminary construction of the scale, which includes steps such as dividing scale dimensions, item sources, and consulting experts for content validity of the scale. The purpose is to assess the rationale behind the scale design.

The second stage entails the preliminary testing of the scale. Construction steps here include testing the reliability and validity of the initial scale, as well as screening scale items through procedures like project analysis and exploratory factor analysis.

The third stage involves the reliability and validity testing of the formal scale. Construction steps include conducting reliability and validity tests to ensure the scale achieves a higher level of statistical reliability and validity.

3.1. Division of scale dimensions and item sources

The concept of emotion management is rich in connotations. Despite extensive research by scholars around the world in many contexts, however, a consistent interpretation has not been reached. In this study, the decisions underlying the subscale divisions were based on the relevant international literature [23–25]. The emotion management subscale was divided into five dimensions: emotional cognition (B1) [26–28], emotion perception (B2), emotion influence (B3) [29–32], emotion control (B4) [33–37], and emotion regulation (B5) [38–41]; the benefit evaluation subscale was divided into outcome evaluation (A1) and process evaluation (A2). The question items initially 56 were developed mainly from our review and analysis of the previously mentioned master's and doctoral dissertations [25–27] relevant academic journals [22,23,26], the emotion measure ment scale [24,28]in the Sports Science Common Psychological Scale Evaluation Manual (edited by Mao Zhixiong), and published psychology and sports psychology books.

3.2. Expert consultation of scale content validity

Seven senior experts and excellent coaches in the industry were selected to evaluate the rationality of the scale's structure and the importance, rationality, and accuracy of the items included in each of the subscales (i.e., emotion management and benefit evaluation of young athletes).

3.3. Preliminary test of the scale

We conducted a preliminary survey to test the reliability and validity of the initial questionnaire. The participants for this survey were from middle schools and universities in Chongqing. A total of 140 questionnaires were issued and 103 were recovered, of which 96 were valid, resulting in an effective recovery rate of 68.6 %.

3.3.1. Reliability of the scale

The overall reliability of the preliminary scale was 0.961; the reliability of the dimensions was 0.839 (A1), 0.835 (A2), 0.927 (B1), 0.878 (B2), 0.906 (B3), 0.917 (B4), and 0.838 (B5). The dimensions and overall reliability of the scale were greater than 0.8, indicating that the scale had good internal consistency.

3.3.2. Validity of the scale

The overall Kaiser-Meyer-Olkin (KMO) value for the scale was 0.802, and the KMO values for the dimensions were 0.802 (A1), 0.861 (A2), 0.791 (B1), 0.856 (B2), 0.856 (B3), 0.918 (B4), and 0.843 (B5). Except for A1, the validity of the dimensions and the total scale was greater than 0.8.

3.4. Screening of scale items

3.4.1. Project analysis

In questionnaire item analysis, the standard for the *t* statistic of the critical ratio is 3. If the *t* value for the difference between the high and low groups is less than 3, the discrimination of the item is considered poor. In this study, an independent samples *t*-test resulted in all items reaching a significant level ($p < 0.05$).

3.4.2. Correlation between questionnaire items and the total scale

The analysis of the correlation between individual items and a scale's total score is a kind of homogeneity test. The stronger the correlation between a given item and the total score, the greater the homogeneity between that item and the whole scale, and the closer the psychological characteristics to be measured. A correlation coefficient that is less than 0.4 indicates that the homogeneity between the item and the whole scale is low, and the item should be deleted. We conducted a bivariate correlation analysis and found that the correlation between all items and the total score reached a significant level ($p < 0.05$), but the correlation coefficients for Q1, Q25, Q35, Q37, Q54 and the total scale were less than 0.4 (0.391, 0.370, 0.372, 0.344, and 0.332, respectively), so these items were deleted.

3.4.3. Homogeneity test-reliability test

If the overall reliability coefficient of a scale after an item is deleted is higher than the original reliability coefficient, it indicates that this item differs in important ways from the other items, and this item should be eliminated. A homogeneity test was conducted sequentially for each dimension. The results for dimension A1 (see Table 1) showed that if Q2 was removed, the reliability coefficient would rise from 0.842 to 0.850, therefore, we removed Q2. After tests were conducted repeatedly until the test did not reach the standard for deletion, Q2 and Q6 were removed from the final dimension A1.

The homogeneity test results for dimensions A2, B1, B2, B3, and B5 showed that none of the items met the exclusion criteria, and thus all items were retained. The results for B4 (see Table 2) showed that if Q38 was removed, the reliability coefficient would increase from 0.888 to 0.912, and the corrected correlation would be 0.323 ($p < 0.4$), thus Q38 was eliminated. The test was performed again, and none of the other items met the criteria for elimination.

3.4.4. Exploratory factor analysis

After completing the above analysis, we conducted a factor analysis for each item in the scale. A limited extraction factor analysis (i.e., a special factor analysis method), principal component analysis, and maximum variance methods were used to calculate the orthogonal rotation axis. If the analysis results contained other components, the item with the highest factor load was deleted, and the factor analysis was carried out again until the results were successfully extracted.

Exploratory factor analysis was also conducted on the scale. According to the results of the first round of factor analysis, component 1 contained items from multiple dimensions, of which B2 (emotion perception) had the most items. Therefore, component 1 represented the dimension B2, and thus item Q10 was deleted because it did not belong to factor B2 and had the highest load. Component 2 contained the two dimensions, B1 and B4; factor B1 had only the item Q13 (see Table 6), which was thus excluded from component 2. Component 5 contained the two dimensions, A2 and B5 (see Table 6); A2 had only item Q11, which was thus eliminated. Component 7 contained only three items Q9, Q12, and Q14which did not belong to the same dimension, those three items were deleted and six factors were retained.

In accordance with the above described elimination principle, we conducted the second round of factor analysis, and deleted the items Q55 and Q56 in component 1. Component 5 and component 6 represented the same dimension; component 6 could explain the variation (3.38 %) and the number of its items were fewer than those in component 5. Therefore, the items Q51, Q52, and Q53 in component 6 were deleted, and five factors were retained. Next, we conducted the third round of factor analysis and found that the results were relatively consistent with the concept. Component 1 contained the two dimensions, B1 and B2. Because of the relationship between the items in B1 and B2, these two dimensions were merged into one dimension, B1, and named emotional perception and emotional cognition. The fourth component contained the two dimensions, A1 and A2. Because A1 and A2 represent the result growth and process growth of training, respectively, they are both benefit evaluations. Therefore, A1 and A2 were merged into one dimension, A1, and renamed "benefit evaluation." Finally, the valuation scale was named the Emotion Management and Benefit of Young Athletes' Training. It was composed of 36 items across 5 dimensions: A1 (benefit evaluation), B1 (emotional cognition), B2 (emotion influence), B3 (emotion control) and B4 (emotion regulation).

Next, we performed KMO and Bartlett sphericity tests on the formal scale. The KMO value was 0.904, $X^2 = 4895.344$, $P = 0.00$ (see Table 3). Four factors with eigenvalues greater than 1 were extracted; the eigenvalues were 13.841, 2.346, 1.811, and 1.357,

Table 1
Homogeneity test results for dimension A1.

Item	Cronbach ratio (if item is deleted)	The Cronbach ratio of dimension A1	Validity of the scale (KMO)
Q2	**0.850**		
Q3	0.778		
Q4	0.799	0.842	0.802
Q5	0.799		
Q6	0.827		

Table 2
Homogeneity test results for dimension B4.

Item	Cronbach ratio (if item is deleted)	The Cronbach ratio of dimension A1	Validity of the scale (KMO)
Q38	**0.912**		
Q39	0.866		
Q40	0.869		
Q41	0.869	0.888	0.918
Q42	0.863		
Q43	0.870		
Q44	0.870		
Q45	0.868		

respectively. The cumulative interpretation rate was 61.782 % of the total variance (see Table 4). The lowest factor load of any scale item was 0.436, the highest factor load was 0.846, and the commonality of all items was between 402 and 0.762 (see Table 5).

3.5. Reliability and validity tests of the formal scale

To test the reliability and validity of the formal scale, students belonging to school sports teams in primary and secondary schools in Chongqing were selected as the test participants. A total of 220 questionnaires were distributed and 152 questionnaires were recovered, representing a recovery rate of 69.09 %. Of these, 143 valid questionnaires were collected, which represented an effective recovery rate of 65 %.

3.5.1. Reliability test of the formal scale

The reliability of the scale was tested using Cronbach's alpha coefficient and a split-half reliability test. The internal consistency reliability of the total scale was 0.895, and the internal consistency reliability of each subscale was between 0.734 and 0.901 (see Table 6), which met the statistical standard. The split-half reliability of the total scale was 0.769, and the split-half reliability of each subscale was between 0.623 and 0.864, indicating that the reliability level of the scale was stable.

3.5.2. Validity test of the formal scale

Tests of validity include content validity, criterion-related validity, and construct validity. In this study, we tested for content validity and construct validity to examine the overall validity of the scale.

3.5.2.1. Content validity. In this study, once a preliminary scale was prepared, we invited experienced researchers, sports workers, and experts to evaluate whether the contents of the scale items truly measured the characteristics represented by the constructs, to ensure that the scale had good content validity.

3.5.2.2. Construct validity. According to the psychologist, Tuker, to construct a rigorous theoretical framework for explaining individual psychological and behavioral traits, the correlation coefficient between each dimension and the total score of the scale test should be greater than the correlation coefficient between each pair of factors, the correlation coefficient of each factor should be between 0.1 and 0.6, and the correlation coefficient between each factor and the total score of the scale should be between 0.3 and 0.8 [19]. In this study, the factors that influenced the correlations between the scale items and the total score of the scale are shown in Table 7. Overall, there was a significant correlation between each factor and the total score of the scale, with coefficients ranging between 0.188 and 0.699, which is basically in line with Tuker's point of view. Therefore, the scale was deemed to have good construct validity.

3.6. Confirmatory factor analysis

In this study, all the data collected were used to test emotion management conducted during training, and the benefit evaluation model, for young athletes; the data were analyzed using Amos 24.0 statistical software for Windows. The purpose was to investigate the model's degree of fit. The SEM model analysis results are shown in Fig. 1. As Table 8 illustrates, the model's NC = 2.660 ($1 < NC < 3$ indicates that the model has a simple fit) [21], PGFI and PNFI values were greater than 0.50, IFI and PRA values were greater than 0.85, RMR <0.05, RMSEA <0.08, all of which met the standard of excellent model fitting. This indicates that the construction of the

Table 3
Bartlett sphericity test and KMO statistics.

	Statistical indicators	Statistical result
Bartlett test of sphericity	Kaiser-Meyer-Olkin	0.904
	chi-square value	4895.344
	degree of freedom	666
	P value	0.00

Table 4
Values and variance contribution rates for factors in the Young athletes' Training Emotion Manag-ement and Benefit Scale.

Factor	Initial eigenvalue			Extract the sum of squares		
	sum	variance%	Cumulative %	sum	variance%	Cumulative %
1	13.841	37.409	37.409	13.841	37.409	37.409
2	3.504	9.470	46.880	3.504	9.470	46.880
3	2.346	6.339	53.219	2.346	6.339	53.219
4	1.811	4.896	58.115	1.811	4.896	58.115
5	1.357	3.667	61.782	1.357	3.667	61.782

Table 5
Young athletes' training-related emotion management and benefits scale.

Item	Component-1	Component-2	Component-3	Component-4	Component-5	Communalities
Q23	0.791					0.682
Q24	0.716					0.762
Q16	0.710					0.736
Q26	0.706					0.528
Q18	0.701					0.501
Q17	0.696					0.662
Q19	0.693					0.707
Q20	0.690					0.683
Q15	0.676					0.739
Q27	0.662					0.600
Q22	0.548					0.587
Q21	0.527					0.508
Q43		0.788				0.573
Q44		0.704				0.705
Q39		0.703				0.616
Q45		0.702				0.625
Q42		0.702				0.623
Q40		0.609				0.615
Q41		0.598				0.535
Q48		0.436				0.528
Q32			0.781			0.487
Q33			0.758			0.635
Q36			0.724			0.596
Q28			0.716			0.508
Q29			0.681			0.606
Q30			0.662			0.671
Q34			0.640			0.663
Q31			0.606			0.659
Q4				0.846		0.741
Q5				0.823		0.685
Q3				0.713		0.649
Q7				0.601		0.644
Q8				0.529		0.665
Q46					0.743	0.402
Q50					0.720	0.534
Q49					0.688	0.637
Q47					0.491	0.564

Table 6
Internal consistency reliability and split-half reliability of the total scale and of each dimension.

		Cronbach Alpha	
A1	Q3、Q4、Q5、Q7、Q8	0.787	0.623
B1	Q15、Q16、Q17、Q18、Q19、Q20、Q21、Q22、Q23、Q24、Q26、Q27	0.828	0.782
B2	Q28、Q29、Q30、Q31、Q32、Q33、Q34、Q36	0.901	0.861
B3	Q39、Q40、Q41、Q42、Q43、Q44、Q45	0.869	0.864
B4	Q46、Q47、Q49、Q50	0.734	0.697
	Q3 …. ….Q56	0.895	0.769

Table 7
Reliability and split-half reliability of the scale.

	A1	B1	B2	B3	B4	
A1	1	0.624[a]	0.188[a]	0.463[a]	0.318[a]	0.662[a]
B1		1	0.412[a]	0.699[a]	0.451[a]	0.885[a]
B2			1	0.374[a]	0.401[a]	0.674[a]
B3				1	0.534[a]	0.820[a]
B4					1	0.664[a]
						1

*: $P < 0.05$.
[a] $P < 0.01$.

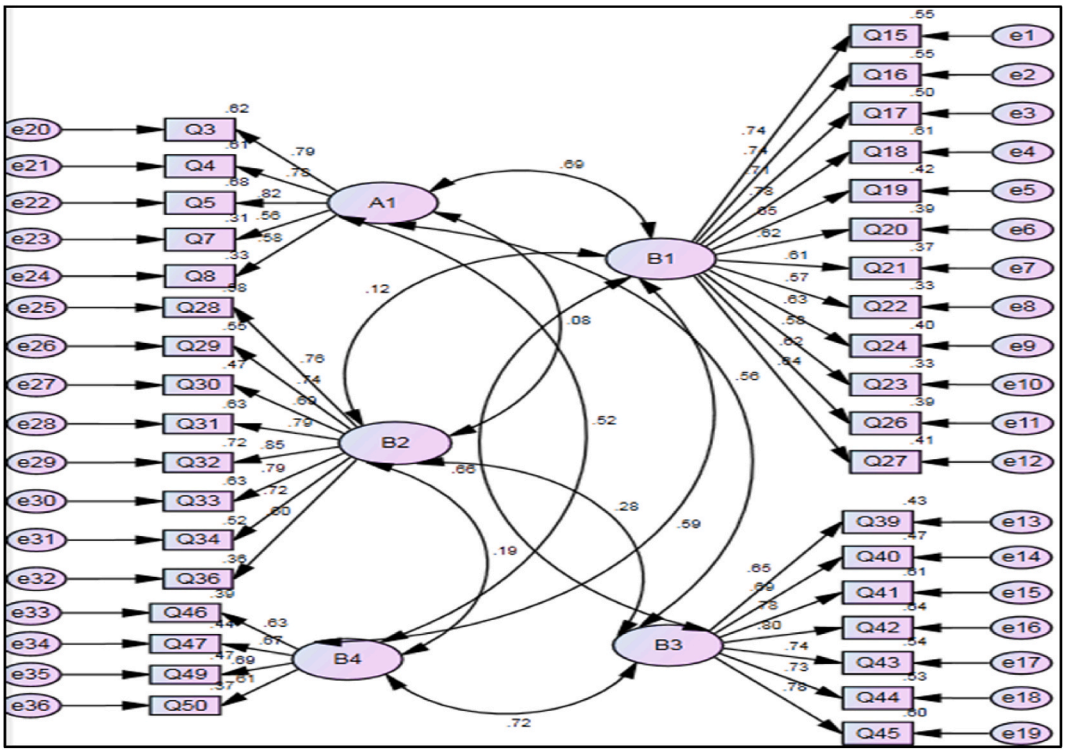

Fig. 1. SEM model analysis results for young athletes' emotion management and its benefits for their training.

Table 8
AMOS structural equation model fitting index.

X^2	df	NC	P	PNFI	PGFI	IFI	RMR	RMSEA
1553.320	584	2.660	0.000	0.699	0.722	0.851	0.006	0.07

model was reasonable, that is, the training-based emotion management and its benefits among young athletes is a multi-dimensional model composed of five factors.

3.7. Overall analysis of the impact of young athletes' emotion management on training efficiency

Using Amos 26.0 structural equation model for analysis, we obtained the influencing path coefficients for each dimension of emotion management's impact on training efficiency (Fig. 2). The path coefficient of "emotional cognition" to training benefit was 0.632; the path coefficient of "emotion influence" to training benefit was 0.110; the path coefficient of "emotion management" to training efficiency was 0.520; and the path coefficient of "emotion regulation" to training benefit was 0.418. "Emotional cognition" was the largest dimension of the training benefit path coefficient in the emotion management structure, indicating its relatively strong impact. These results suggest that thorough attention should be given to the cultivation of young athletes in their early basic training process, that the psychological aspects of young athletes' emotional cognition should be continuously addressed, and that emotion-

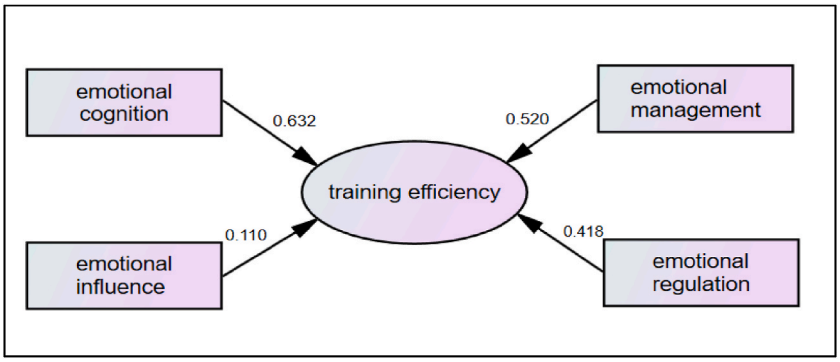

Fig. 2. Path analysis of the impact of young athletes' emotion management on their training efficiency.

focused psychological knowledge and technical training should be incorporated into athletic programs for young people. Furthermore, the process of cultivating early young athletes' emotional cognition should be coordinated with the technical training of their emotion control and regulation, as we strive to optimize the development of their emotion management skills.

4. Discussion

The internal consistency reliability of the formal scale, "Young Athletes' Training Emotion Management and Benefits," was 0.895, and the internal consistency reliability of each subscale was between 0.734 and 0.901. The split-half reliability of the total scale was 0.769, and the split-half reliability of each subscale was between 0.623 and 0.864. Overall, the internal consistency reliability and split-half reliability of the formal scale were good, which met statistical standards. The test results had good consistency, stability, and reliability. The results indicate that emotion management that is taught during training, and its expected benefits, for young athletes consists of five dimensions: benefit evaluation, emotional cognition, emotion influence, emotion control, and emotion regulation.

Our research results were basically the same as those of previous studies [42,43] and we believe that emotional management may be composed of the dimensions discussed above. The results of this study showed that "emotional cognition" had the greatest impact on training effectiveness ($r = 0.690$), which differed from previous studies. Josefsson et al. [44]found that emotional regulation had a high mediating effect on sports performance, and that emotional regulation had the greatest impact on sports performance. Another study found that the level of emotional state directly affected the competition performance of combat athletes.

It has been proposed that emotional regulation can be performed through adaptive and biofeedback training [45]. The reason for the different results of our study may be that previous studies mainly focused on adult athletes or athletes with a large amount of competition experience. These athletes already had a certain empirical basis, and were able to adjust their emotional state during the competition to achieve the desired results. The focus of our study was young athletes. Because of their young age, lack of competition experience, and no practical experience, their emotional regulation ability was likely to be lower than that of adults and experienced athletes. Therefore, there were differences in the impact of emotional management on sports performance between these groups. This study confirmed that the emotional cognition of young athletes had the greatest impact on their training efficiency. Therefore, in the process of training practice, coaches should pay special attention to cultivating the emotional cognition of young athletes and offer more emotional management auxiliary training.

The influence coefficients of emotion management and emotion regulation on training effectiveness were 0.418 and 0.520, respectively, which were slightly lower than that for emotion cognition. Therefore, in the process of training practice, the influence of emotional management and emotional regulation on training efficiency cannot be ignored. In the process of scheduled training practice, we should pay attention to the overall cultivation of emotional cognition, emotional management, and emotional regulation, so that young athletes' overall emotional management ability can be developed in a balanced way. This will help prepare them for large-scale events and competitions and facilitate the achievement of excellent sports results. In the early stage of training for young athletes, it is necessary to train their emotional management.

First, it is necessary to diagnose the initial state of the emotional management level of young athletes who have just participated in training, clarify the initial emotional management level of each young athlete and divide the level, and conduct targeted psychological skills training according to these different levels. Second, coaches should conduct centralized training for young athletes, explain the importance of emotional management for training effect and competition, and explain the successful cases of excellent international athletes' emotional management so that young athletes can understand the importance of emotional management.

In training practice, the cultivation of young athletes' emotional management should also consider the following points. There may be differences in the emotional management level, emotional influence, emotional control, and emotional adjustment of young athletes of different ages. There may also be differences in the coaches should conduct personalized training based on the situation of individual athletes as there are also differences in the level of emotional state of athletes with different training years and backgrounds. Because emotions are affected by many aspects (e.g., learning environment, family environment, social interaction), coaches should understand athletes' training and social backgrounds to inform personalized emotional management training.

5. Conclusion

On the basis of interviews and literature reviews, we proposed a theoretical hypothesis of the emotion management training and its benefits for the development of young athletes and devised an empirical study to test the hypothesis. The results indicate that emotion management that is taught during training, and its expected benefits, for young athletes consists of five dimensions: benefit evaluation, emotional cognition, emotion influence, emotion control, and emotion regulation [22–24].

The Young athletes' Training Emotion Management and Benefits evaluation scale has good reliability and validity, and there is a clear distinction between the items, which meets the statistical requirements. The correlation coefficient between the total score of the scale and each factor is higher than that between the factors. The dimensions of the scale are relatively independent. Each dimension reflects some psychological trait to be measured by the total scale and has good construct validity [25]. This scale can be used as an effective measurement tool to evaluate training-based emotion management [26]and its benefits for young athletes' training outcomes.

There were significant correlational differences between all dimensions (emotional cognition, emotion influence, emotion control, emotion regulation, and benefit evaluation). The correlation between emotional cognition and benefit evaluation was the highest, and the correlation between emotion influence and benefit evaluation was the lowest. In addition, there was a moderate correlation between emotion control, emotion regulation, and benefit evaluation. The scale provides a more practical measurement tool for and theoretical structure on which to base further research on the effects of emotion management and development on young athletes' training efficiency in their training process.

Owing to the particular demands of this study, the items in each dimension of the scale are relatively concentrated; therefore, it is recommended that administrators randomly distribute all items before conducting the survey. Furthermore, some items should be revised as direction questions according to the research needs, to avoid influencing the participants' mindset, and to identify participants who do not take the questions seriously and risk affecting the quality of the data.

Declaration of ethical approval

This study was reviewed and approved by the Sports Science Experiment Ethics Committee of Beijing Sport University, with the approval number:2023099H.

Data availability statement

Data will be made available on request.

CRediT authorship contribution statement

Lingfei Meng: Writing – review & editing, Writing – original draft, Validation, Supervision, Software, Data curation, Conceptualization. **Xiao Liang:** Project administration. **Biyu Zhang:** Methodology, Conceptualization. **Jianping Liang:** Writing – review & editing, Project administration.

Declaration of competing interest

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

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e30069.

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