

The Psychological Factors of Exercise Addiction in High-Level Chinese College Soccer Players

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Exercise addiction (EA) is a pathological behavior exhibited by individuals obsessed with exercise. It seriously affects the daily lives of addicted individuals and endangers their physical and mental health. PURPOSE: To investigate the prevalence of exercise addiction and the psychological contributors to its formation in high-level college soccer players. METHODS: Data were obtained from questionnaires completed by high-level college soccer players in China. Ordinary least squares (OLS) regression analysis and conditional process analysis were used to explore the psychological factors and mechanisms underlying the formation of exercise addiction in high-level college soccer players. RESULTS: 1. The prevalence of exercise addiction among college high-level soccer players was 31.3%; 2. Exercise identity, exercise beliefs, and sports participation motivation significantly positively affected exercise addiction ($p < .01$); 3. Exercise beliefs and sports participation motivation was a substantial mediating factor ($p < .01$) on exercise identity effects on exercise addiction. Gender showed a significant moderating effect on the influence of exercise identity on exercise beliefs ($p < .05$). CONCLUSIONS: 1. High-level college soccer players are a high-risk group for exercise addiction; 2. Exercise identity, exercise beliefs, and sports participation motivation are predictors of exercise addiction in high-level college soccer players; 3. The exercise identity of high-level college soccer players has both a direct effect on exercise addiction and an indirect effect on exercise addiction by influencing two mediating variables: exercise beliefs and sports motivation participation. Gender moderates the extent to which exercise identity influences exercise beliefs.

KEY WORDS: College; High-Level Soccer Players, Exercise Addiction, Psychological Factors.

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Exercise not only promotes physical and mental health but is also a means of de-stressing and relaxation. Anything taken to extremes can have a negative effect, however, and this principle is true for exercise. Extreme exercise behavior is known as exercise addiction, a term which highlights its negative effects on people's physical and mental health. Also called exercise dependence, compulsive exercise, or obligatory exercise (Griffiths et al., 2015; Kovácsik et al., 2021), exercise addiction is a behavioral addiction and psychiatric disorder (Ma, 2011). Due to the low prevalence of exercise addiction in the general population and the rarity of extreme exercise behavior, this psychiatric disorder is not currently included in the Diagnostic and Statistical Manual of Mental Disorders (DSM) (Qu & Yao, 2017). It does, however, exist and affects the physical and mental health, as well as the daily lives of exercisers. Exercise addiction is defined as uncontrolled, compulsive exercise behavior that impairs the physical and psychological health of the individual (Juwono, Tolnai, & Szabo, 2022). People who suffer from exercise addiction usually exhibit three or more of the following symptoms: (1) Tolerance: the requirement to continuously increase the amount of exercise to achieve the desired exercise effect; (2) Withdrawal symptoms: stopping exercising for a period of time leads to negative emotions such as fatigue and anxiety, causing a need to resume exercise to reduce or avoid such negative effects; (3) Intention effects: exercising more often or for a longer period of time than intended; (4) Loss of control: the desire or effort to reduce or control movement always ends in failure; (5) Time spent: a great deal of time is spent on sports and related activities; (6) Conflict: a reduction or abandonment of vital social, occupational, or leisure interests as a result of exercise; (7) Continuance: continuing to exercise despite knowing that persistent or recurrent physical or psychological problems may be caused and aggravated by exercise (Hausenblas & Downs, 2002; Freimuth, Moniz, & Kim, 2011).

Exercise addiction research started in more affluent European and American countries. With the rising expansion of sports in China, this behavioral addiction has increasingly attracted the attention of Chinese researchers (Lv, 2015). Exercise addiction develops as a result of a combination of physiological, psychological, and social variables (Xie & Li, 2007). As exercise addiction is generally considered a psychiatric disorder, a considerable number of empirical studies in academia have focused on the psychological aspects of exercise addiction development. These include studies on the relationship between personality traits and exercise addiction (Costa & Oliva, 2012), studies on the relationship between exercise identity and exercise addiction (Cook et al., 2015; Turton, Goodwin, & Meyer, 2017), studies on the relationship between exercise beliefs and exercise addiction (Murray et

al., 2013; Lichtenstein & Jensen, 2016), studies on the relationship between sports participation motivation and exercise addiction (Conesa, Plaza, & Palacios, 2017). However, research on exercise addiction in China started late, and quantitative studies on the psychological factors underlying the formation of exercise addiction are even scarcer (Gong & Wang, 2023; Zhu & Zhang, 2022). With the introduction of the “Healthy China 2030 Program”,¹ China has put exercise at the center of its strategy, and research on exercise addiction is gradually emerging. There are currently fewer studies on exercise addiction carried out by Chinese researchers. In terms of research on the psychological factors involved in the formation of exercise addiction, it only involves research on the relationship between personality traits, sports motivation, sensation seeking and exercise addiction (Qu & Yao, 2017; Zhang, 2014; Zhang, 2019). The relationship between exercise identity, exercise beliefs, and exercise addiction has not been examined in any research. Consider the important influence of exercise identity, exercise beliefs, and sports participation motivation on the emergence of exercise addiction, this study focused on the relationship and mechanism between these three psychological factors and exercise addiction in the Chinese Chinese Context.

According to identity theory, the activation of an identity promotes the development of behavior that is compatible with that identity (Murray et al., 2013). Action impacts the individual’s perceived self, which adjusts so that it is consistent with the individual’s behavior (Stryker & Burke, 2000). People with a strong exercise identity tend to develop a need to match or maintain that exercise identity, and the need specifies the content of athletic motivation and guides and motivates individual athletic behavior (Deci & Ryan, 2000). Accordingly, exercise identity may trigger various motivations for participation in sports.

Individual emotional changes are also linked to identity perception. According to identity theory, gaps between perceived self-meaning and actual identity impact mood and emotions, and self-meaning is generally decided by one’s own behavior. Consistency between behavior and identity produces positive emotions; inconsistency produces negative emotions (Deci & Ryan, 2000). An athlete’s exercise beliefs include the perception of negative consequences of inactivity; these consequences include the negative emotions that arise when the exercising individual does not exercise or does not exercise

¹ The Central Committee of the Communist Party of China and the State Council issued the Outline of the “Healthy China 2030 Program”. (no date b) CPC Central Committee and State Council issue Outline of the “Healthy China 2030 Program” _Related Documents of the Central Government_China.org.cn. https://www.gov.cn/zhengce/2016-10/25/content_5124174.htm

enough to accord with his or her exercise identity. Individuals with a strong exercise identity require a great deal of exertion to align their perceived exercise identity with their behavior, and achieving such alignment daily is difficult. As a result, individuals with high exercise identity tend to have negative emotions due to the inconsistency between their behavior and their exercise identity. Poor exercise beliefs reflect these negative emotions. Based on association, the present study posits that high exercise identity may promote poor exercise beliefs.

Gender is another factor that impacts exercise beliefs and sports participation motivation. Previous studies have indicated that males have stronger exercise beliefs than females (Loumidis, 2018). Moreover, males are more driven by competitiveness in exercise, whereas females are more motivated by weight control. (Lichtenstein et al., 2014).

Based on the preceding discussion, this study presents a hypothetical model of the mechanism of exercise addiction development. The model assumes that exercise identity has a direct effect on exercise addiction and can also have an indirect effect on exercise addiction by influencing two mediating variables: exercise beliefs and sports participation motivation. Gender moderates the extent and direction of the influence of exercise identity on exercise beliefs and sports participation motivation, respectively (see Fig. 1).

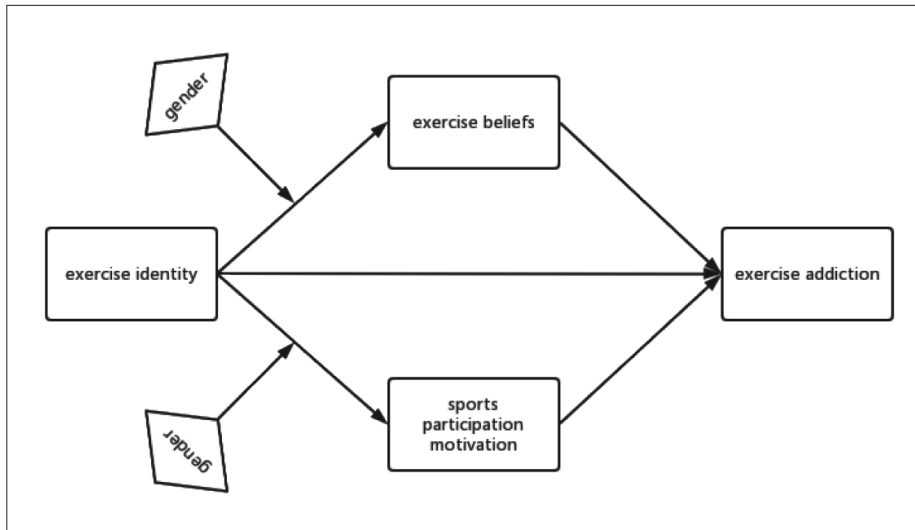


Fig. 1. - Proposed Model of the Formation Mechanism of Exercise Addiction Based on Identity Theory.

Research on the prevalence of exercise addiction indicates the demographic characteristics of this behavioral addiction, which provides information not only on the prevalence of exercise addiction in a given exercise group but also on the relationship between exercise addiction and the frequency, duration, and type of exercise. Individuals who exercise more frequently and for longer periods in each session are more prone to develop exercise addiction; individuals who participate in soccer, basketball, and other sports with high levels of competition are more likely to develop exercise addiction (Qu et al., 2015). However, the formation of exercise addiction is not only related to the frequency, duration, and exercise type but is also closely related to the level of competition of the athletic group. Research shows that competitive athletes are more likely to develop exercise addiction than leisure exercisers (De la Vega et al., 2016).

A review of existing research reveals exercise addiction research has been conducted primarily with fitness fanatics (Li & Yang, 2022), amateur runners (Lukács et al., 2019), and other leisure exercisers. Few studies have investigated the prevalence of exercise addiction and the psychological characteristics that lead to its development among elite athletes. The demographic characteristics of exercise addiction suggest that the number of workouts per week, the duration of a single workout, and competitiveness all contribute to the development of exercise addiction. High-level soccer players, according to the demographic characteristics of exercise addiction, are expected to be a group with a high incidence of exercise addiction due to the high number of weekly training sessions and the highly competitive and confrontational nature of the sports they play. Research on psychological factors in the development of exercise addiction has shown that exercise identity, exercise beliefs, and motivation to participate in exercise are associated with the development of exercise addiction (Cook et al., 2015; McNamara & McCabe, 2012; Conesa, Plaza, & Palacios, 2017). However, no research has investigated how these psychological factors influence the development of exercise addiction in high-level soccer players in the Chinese context. In Chinese collegiate soccer, many players display sports behaviors similar to exercise addiction. This phenomenon begs a series of questions: Do high-level college soccer players exhibit exercise addiction? What is the prevalence of addiction in this group? What effect do exercise identity, exercise beliefs, and sports participation motivation have on the development of sports addiction behaviors in this group in China? A study of the exercise addiction of high-level college soccer players in China will answer these questions and fill a research gap. Furthermore, by investigating the psychological factors that contribute to the development of exercise addiction in this group and

the interactions between these factors, we can establish a foundation for the prevention and intervention of this addiction behavior in this population.

Based on previous studies, this study takes high-level college soccer players as research subjects and proposes three hypotheses: 1. Exercise identity, exercise beliefs, and sports participation motivation will significantly predict exercise addiction behavior; 2. Exercise beliefs and sport participation motivation mediate the influence of exercise identity on exercise addiction; 3. Gender moderates the degree and direction of the influence of sport identity on sports beliefs and sport participation motivation.

Methods

PARTICIPANTS

In this study, most participants had earned the state-authorized technical rank of (from low to high) Level 2, Level 1, or National Level,² they are all high-level soccer players. Technical athletic grades provide official national recognition of an athlete's technical ability, and the General Administration of Sports of China is responsible for issuing the appropriate grade certificate to athletes who have earned a technical athletic grade.³ In China, the Chinese University Football Association (CUFA) High Level Group is divided into three divisions: Super Group League, Grade A Group League, and Grade B Group League. Almost all college soccer players in these leagues are high-level players, though high-level soccer players can also be found at some colleges and universities that do not participate in the CUFA.

Based on the distribution of high-level soccer players in China, this study selects soccer players as research subjects from some colleges within the three levels of association and some colleges that do not participate in the association but have a high-level soccer player enrollment policy. The samples were from at least 43 Chinese colleges. The snowball sampling was used to collect data and the survey was conducted by distributing online questionnaires. The exclusion criteria were: (a) to be less than 17 years of age, (b) questionnaire with incomplete demographic information, and (c) questionnaires that take too little time to complete. A total of 319 valid questionnaires were collected, of which 25 were discarded because they met the exclusion criteria.

Of the subjects, 87.1% were male (n=278), 12.9% were female (n=41), the minimum age was 17, the maximum age was 29, and the average age was 20.6 years old. Broken down by level, 6.3% (n=20) of the soccer players in the sample did not have an athletic rank, 29.2% (n=93) were Level 2 athletes, 62.4% (n=199) were Level 1 athletes, and 2.2% (n=7) were National Level athletes (Table I). Participants who did not have a high

² In China, the word "high-level" is also used to describe professional athletes. Both student and professional athletes are referred to as "high-level athlete" if they are able to earn the state technical certificate.

³ State Sports General Administration Order (No. 18) Measures for the Administration of Technical Levels of Athletes. State Council Gazette No. 15 of 2014_China.gov.cn. (n.d.; in Chinese). https://www.gov.cn/gongbao/content/2014/content_2684475.htm

TABLE I
General Description Of Sample

Variables	Exercise addiction	Non-exercise addiction
	Quantity(%)	Quantity(%)
Gender	93 (33.5)	185 (66.5)
Male (n=278)		
Female (n=41)	7 (17.1)	34 (82.9)
Sport level	5 (25.0)	15 (75.0)
NAR(n=20)		
L2(n=93)	31 (33.3)	62 (66.7)
L1(n=199)	59 (29.6)	140 (70.4)
NL(n=7)	5 (71.4)	2 (28.6)
Age	90 (32.3)	189 (67.7)
17~22(n=279)		
23~29(n=40)	10 (25.0)	30 (75.0)
Total	100 (31.3%)	219 (68.7%)

NAR is no athletic rating; L2 is Level 2 athlete; L1 is Level 1 athlete; NL is National Level.

level soccer certification may have been high-level athletes in another sport or athletes without a certification who nonetheless could compete at a high level. Those participants without certifications were included in the study because they joined their schools' high-level soccer teams, underwent systematic and intensive training with high-level soccer players, and formed habits and movement patterns similar to the high-level players over a sustained period of time.

VARIABLES AND MEASURES

Exercise addiction

As discussed, exercise addiction is characterized by compulsive exercise behavior that negatively impacts an individual's physical and mental health as well as daily life. This study used the "Exercise Addiction Inventory (EAI)" to measure exercise addiction (Terry, Szabo, & Griffiths, 2004). The EAI consists of six items (e.g., "Exercise is the most important thing in my life"), rated on a 5-point Likert scale from "1=strongly disagree" to "5=strongly agree." Those scoring 24 or higher were considered to be at risk for exercise addiction. Most previous studies have used the EAI or Exercise Dependence Scale (EDS) to measure exercise addiction. This study used EAI based on two key factors: first, in both international and domestic (Chinese) studies, EAI has been demonstrated to have high reliability and validity (Kovácsik et al., 2020; Qu, 2016). Second, as compared to the EDS, the scale is more concise, easier to administer (Granziol et al., 2021), and more suitable for research studies with a large sample.

Exercise identity

Identity theory holds that once an individual has assigned themselves a role, the behavioral patterns associated with that role will be internalized as the individual's own. Hence, exercise identity is described as a person's self-concept that emphasizes prior exercise behavior and drives future exercise behavior (Cook et al., 2015). That is, if people connect with an "exercise identity," they will assign meaning and worth to their previous exercise behavior while also providing guidance for their future behaviors (Anderson et al., 1994). Individuals with high exercise identity are prone to excessive exercise behavior and may eventually develop an exercise addiction (Murray et al., 2013). The Exercise Belief Scale developed by Anderson and Cychosz was selected to measure exercise beliefs (Anderson & Cychosz, 1994). The EIS consists of nine items (e.g., "I consider myself an exerciser"; "When I describe myself to others, I usually include my involvement in exercise") are rated on a 5-point Likert scale from "strongly disagree" to "strongly agree," with higher scores indicating a stronger exercise identity.

Exercise beliefs

Exercise beliefs, defined as exercising individuals' view of the negative consequences of inactivity, are closely related to the development of exercise addiction. The more concerned an exercising individual is about not being able to function cognitively or emotionally, express themselves, or maintain their appearance and physical health if they do not exercise, the more likely they are to exercise more frequently and for a longer period of time (Loumidis, 2018). Therefore, this study aimed to explore exercise beliefs as one of the main psychological components in predicting exercise addiction. The "Exercise Beliefs Questionnaire (EBQ)" developed by Loumidis and Wells was used to assess exercise beliefs (Loumidis & Wells, 1998). EBQ consists of twenty items (e.g., "If I do not exercise I will be an uninteresting person"; "If I do not exercise I will look bad"; and "If I do not exercise I will not be able to work efficiently") are rated on a scale of 1 to 10, with higher-scoring exercise individuals having stronger exercise beliefs. It is important to note that the Exercise Beliefs Scale describes unhealthy exercise beliefs. The current study postulated that it is this unhealthy exercise belief that leads to exercise addiction in athletes.

Sports Participation Motivation

Self-determination theory, commonly used to explain motivation for sports participation (Guedes & Netto, 2013), classifies motivation as intrinsic or extrinsic. When people decide whether to continue exercising, they draw on both intrinsic and extrinsic motivation. Intrinsic motivation is strongly tied to the activity itself, such as improving motor abilities and being engaged in the sport; extrinsic motivation is independent of the sport itself, such as enhancing the exerciser's physical appearance and earning rewards (Kovácsik et al., 2020). Regardless of the motivation for the excessive pursuit of sports, it is possible to develop exercise addiction.

The sports participation motivation were obtained by application of the Participation Motivation Questionnaire (PMQ), which was developed by Gill, Gross, and Huddleston (Gill, Gross, & Huddleston, 1983). Some of the original PMQ items, such as reasons for exercising: "To leave the house," "To use the equipment," "To have something to do," and "To travel" were deleted since they did not apply to high-level Chinese college soccer players. Therefore,

this study used a revised version of the Participation Motivation Questionnaire (PMQ) to measure the level of sports participation motivation of high-level college soccer players. The revised PMQ scale consists of nineteen items in six dimensions (see Appendix A). Items (e.g., “To be popular,” “Because I like the team spirit,” and “To get in shape”) are rated on a 5-point Likert scale from 1 (“strongly disagree”) to 5 (“strongly agree”), with higher scores suggesting a greater level of motivation to participate in sports. The validity and reliability of the revised scale is shown in Appendix B and Appendix C.

Covariates

Related research indicates that the onset of exercise addiction is influenced by gender, age, and sport level (Vega et al., 2016; Szabo et al., 2013; Dumitru et al., 2018). Therefore, covariates include gender (male=1; female=2), age (mean=20.69; SD=2.06), and sport level (No athletic rating=1; Level 2 athlete=2; Level 1 athlete=3; National Level athlete=4).

Reliability and validity tests of measurement instruments

In this study, the gender, age, and exercise class of the subjects were determined by a demographic questionnaire. The Exercise Addiction Inventory (EAI) was used to assess exercise addiction, while the Exercise Identity Scale (EIS), Exercise Beliefs Questionnaire (EBQ), and Participation Motivation Questionnaire (PMQ) were used to assess exercise identity, exercise beliefs, and motivation for exercise participation. These scales were assessed to have relatively good reliability and structural validity. In terms of reliability, the Cronbach’s alpha coefficients for the scales were 0.629, 0.906, 0.965, and 0.920, respectively (Appendix C). In terms of structural validity, the rotated component matrix of each scale item was generally consistent with the structure of the original scale, and the factor loading of each question and its co-factors met the requirements for statistical analysis.

Procedure

After the final version of the questionnaire was confirmed, the reliability and validity of the questionnaire were tested. The results of the reliability and validity of the questionnaire have been illustrated above. Next, the online questionnaire was distributed to each selected high-level soccer team through their classmates or teachers. Participants can fill out the questionnaire from anywhere via the web questionnaire link. The online questionnaire consisted of two parts, the informed consent form and the questionnaire content. All responses were anonymous and no personally identifiable information was requested. Participants will receive a cash prize of a certain amount upon completion of the questionnaire. The cost of the study was provided by the authors themselves.

Statistical Analysis

First, descriptive statistical analysis was performed to provide an overview of the exercise addiction and demographic characteristics of the sample. Sec-

ond, ordinary least squares (OLS) regression models were developed, and regression analyses were conducted to examine the linear relationship between exercise addiction and exercise identity, exercise beliefs, and sports participation motivation. Finally, conditional process analysis (CPA) was used to evaluate the mediating effects of exercise beliefs and sports participation motivation and the moderating effect of gender in the proposed model. CPA is a technique that combines moderating effects analysis with mediating effects analysis within the framework of path analysis. In this study, CPA is implemented under the Process Plug-In with the relevant commands. The Process Plug-In was written by Hayes and run through SPSS (Hayes et al., 2017).

Results

Prevalence of exercise addiction among high-level college soccer players

Among the 319 high-level soccer player participants, the number with exercise addiction behaviors was 100, for an exercise addiction prevalence of 31.3%. In terms of gender, 93 male players had exercise addiction behavior, with a rate of 33.5%, and 7 female players had exercise addiction behavior, with a rate of 17.1%. In terms of age, a total of 90 athletes between the ages of 17 and 22 had exercise-related addiction behaviors, with an addiction rate of 32.3%; 10 athletes between the ages of 23 and 29 had such behaviors, with an addiction rate of 25.0%. In terms of sports levels, there were 5, 31, 59, and 5 athletes with exercise addiction behaviors at the no athletic rating, Level 2, Level 1, and National Level, respectively, with corresponding addiction rates of 25.0%, 33.3%, 29.6%, and 71.4% (see Table I).

OLS regression analysis of psychological factors in the formation of exercise addiction

The relationship between exercise addiction and each influencing factor was investigated through OLS regression analysis. Exercise addiction was used as the dependent variable, exercise identity, exercise beliefs, and sports participation motivation as independent variables, and gender, age, and sport level as control variables. Among them, the control variable gender and sport level (denoted as gender and sl, respectively) are categorical variables. The dependent variable exercise addiction (EA), the independent variables exercise identity, exercise beliefs, and sports participation motivation (EI, EB, and PM, respectively), and the control variable age are all con-

tinuous variables. In order to include the gender and sport level variables in the OLS regression model, the variables gender and sport class were set as dummy variables. Gender was set as a two-point dummy variable (female as the reference group) and sport level was set as a four-point dummy variable. In the setting of sport-level dummy variables, no athletic rating was used as the reference group to form three dummy variables sl2, sl3, and sl4, which denote Level 2, Level 1, and National Level, respectively. This led to the construction of the OLS regression model [Equation 1] as follows:

$$EA = \alpha + \beta_1 \cdot EI + \beta_2 \cdot EB + \beta_3 \cdot PM + \lambda \cdot \text{age} + \theta_1 \cdot \text{gender} + \theta_2 \cdot \text{sl2} + \theta_3 \cdot \text{sl3} + \theta_4 \cdot \text{sl4} + \varepsilon$$

Where α denotes the constant; β_1 , β_2 , and β_3 are the regression coefficients of the independent variables exercise identity, exercise beliefs, and sports participation motivation, respectively; λ denotes the regression coefficient of the control variable age; θ_1 , θ_2 , θ_3 , and θ_4 are the regression coefficients of the dummy variables gender and exercise class, respectively; and ε is the residual. The coefficient values and significance of the respective variables and control variables are shown in Table II.

Using the forced entry method, a statistically significant regression equation was obtained ($F=23.769$, $p<.01$, $R=0.617$, $R^2=0.380$). With t -values of 3.901 ($\beta=0.198$, $p<.001$), 2.792 ($\beta=0.146$, $p=.006<.01$), and 6.673 ($\beta=0.369$, $p<.001$) for the significance test of the regression coefficients of the three independent variables, all can be considered significant. These results show that after controlling for gender, age, and sport level, the factors of exercise

TABLE II
OLS Regression Analysis of Psychological Factors in the Formation of Exercise Addiction

	B	SE	Beta(β)	t	P
Constant	8.581	2.174		3.996	<.001***
EI	0.109	0.028	0.198	3.901	<.001***
EB	0.011	0.004	0.146	2.792	.006**
PM	0.112	0.017	0.369	6.673	<.001***
gender	1.413	0.465	0.145	3.040	.003**
age	-0.046	0.085	-0.025	-0.545	.586
sl2	-0.618	0.646	-0.086	-0.956	.340
sl3	-0.722	0.614	-0.107	-1.175	.241
sl4	1.452	1.187	0.065	1.223	.222
R=61.7 R ² =0.380 F=23.769**					

$p<.05^*$, $p<.01^{**}$, $p<.001^{***}$ (two-sided test).

identity, exercise beliefs, and sports participation motivation had a positive effect on exercise addiction, indicating that high exercise identity, strong exercise beliefs, and sports participation motivation significantly predict the development of exercise addiction in high-level college soccer players. In addition, the *t*-value of 3.040 ($\beta=0.145$, $p=.003 < .01$) for the significance test of the gender regression coefficient reached a significant level, indicating a positive effect of gender on exercise addiction. Specifically, male players are more likely than female players to develop exercise addiction behaviors. According to the standardized regression coefficients, sports participation motivation had the greatest effect on exercise addiction, followed by exercise identity and exercise beliefs. Gender had the least effect on exercise addiction (see Table II). The findings support hypothesis 1.

CONDITIONAL PROCESS ANALYSIS OF THE FORMATION MECHANISM OF EXERCISE ADDICTION

To examine the specific mechanisms of action on the linear relationship between exercise addiction, exercise identity, exercise beliefs, and sports participation motivation, a hypothetical model of the formation mechanism of exercise addiction was constructed according to identity theory. A conditional process analysis based on the Process Plug-In was applied to test the model.

The influence of exercise beliefs and sports participation motivation as mediating variables of the effect of exercise identity on exercise addiction are shown in Table III. The direct effect indicates the influence path of “exercise identity→exercise addiction” with a direct effect value of 0.103 ($p=.0003<.01$), indicating that exercise identity can directly influence the formation of exercise addiction.

In terms of mediating effects, the path of influence indicated by the effect values for each stage in Table III is: “exercise identity→exercise beliefs→exercise addiction.” The effect of exercise identity on exercise beliefs had an effect value of 4.990 ($p < .001$); the effect of exercise beliefs on exercise addiction had an effect value of 0.012 ($p=.0016 < .01$). The indirect effect value of the “exercise identity→exercise beliefs→exercise addiction” pathway is $4.990 \times 0.012 = 0.060$, which indicates that exercise identity indirectly influences the formation of exercise addiction through exercise beliefs. Table 3 also reflects the effect values for each stage of the “exercise identity→sports participation motivation→exercise addiction” influence pathway. The effect of exercise identity on sports participation motivation (first stage) had an ef-

fect value of 1.126 ($p < .001$); the effect of sports participation motivation on exercise addiction (second stage) had an effect value of 0.117 ($p < .01$). The indirect effect value of the “exercise identity \rightarrow sports participation motivation \rightarrow exercise addiction” pathway was $1.126 \times 0.117 = 0.132$, which indicates that exercise identity influences the formation of exercise addiction by influencing sports participation motivation.

TABLE III
Mediating Effects Of The Mediation Model Of Exercise Identity \rightarrow Exercise Beliefs \rightarrow Exercise Addiction And Exercise Identity \rightarrow Sport Participation Motivation \rightarrow Exercise Addiction

Path		Coeff.	SE	t	p	Bootstrap confidence intervals (95%)
Mediate effect of exercise beliefs	First-stage effect	4.990	1.165	4.284	<.001***	[2.698, 7.281]
	Second-stage effect	0.012	0.004	3.199	.0015**	[0.005, 0.020]
Mediate effect of sport participation motivation	First-stage effect	1.126	0.267	4.215	<.001***	[0.600, 1.651]
	Second-stage effect	0.117	0.017	6.962	<.001***	[0.084, 0.150]
Direct effect		0.103	0.028	3.697	.0003***	[0.048, 0.158]

$p < .05^*$, $p < .01^{**}$, $p < .001^{***}$ (two-sided test).

Exercise beliefs and sports participation motivation serve as mediating factors that affect how exercise identity impacts exercise addiction. The sum of each indirect effect and each direct effect is the overall mediating effect: $0.060 + 0.132 + 0.103 = 0.295$. This result supports hypothesis 2.

TABLE IV
Moderating Effect of Gender on Exercise Identity and Exercise Beliefs, Exercise Identity, and Sport Participation Motivation

Depend. variables	Variable	Coeff.	SE	t	p	Bootstrap confidence intervals (95%)
EB	gender	119.008	46.057	2.584	.0102*	[28.390, 209.627]
	gender \times EB	-3.093	1.238	-2.503	.0128*	[-5.536, -0.663]
PM	gender	15.575	10.562	1.475	.1413	[-5.207, 36.356]
	gender \times PM	-0.3679	0.2840	-1.295	.1962	[-0.927, 0.191]

$p < .05^*$, $p < .01^{**}$, $p < .001^{***}$ (two-sided test).

Table IV shows the statistical results of the moderating effect of gender on the influence of exercise beliefs and sports participation motivation. The regression coefficient of the gender interaction term did not reach a significant level in the regression model with sports participation motivation as the dependent variable ($p=.1962 > .05$) but reached a significant level in the regression model with exercise beliefs as the dependent variable ($p=.0128 < .05$). The moderating effect value of -3.093 , indicating that the degree of influence of exercise identity on exercise beliefs differed for soccer players of different genders and that male players' exercise identity had less influence on their exercise beliefs than female players'. This result partially supports hypothesis 3: gender does not moderate the effect of exercise identity on sports participation motivation but can moderate the influence of exercise identity on exercise beliefs.

Discussion

The descriptive statistical analysis revealed that the prevalence of exercise addiction in high-level Chinese college soccer players was 31.3%. The high prevalence of exercise addiction in this group deserves attention from college soccer coaches and players themselves. Through cross-study comparison, it was found that the exercise addiction rate of Chinese college high-level soccer players was higher than that of amateur exercise groups such as college students groups, running enthusiasts groups, and fitness enthusiasts groups (Qu et al., 2015; Li, 2020; Di Lodovico et al., 2019), all of which used the EAI as a tool to measure exercise addiction. According to a review of studies on the prevalence of exercise addiction in high-level athletes, these individuals are at significantly higher risk for developing exercise addiction than the general population and people who regularly exercise, with rates of addiction reaching 40% or higher (Juwono, Tolnai, & Szabo, 2022), which is comparable to the 31.3% rate of exercise addiction among high-level college athletes in this study. Exercise addiction has a variety of detrimental impacts on education or work, daily life, and even the athletic skill development of high-level college soccer players, in addition to putting their physical and mental health at risk. Research has shown that exercise addiction does not benefit the development of athletic performance and may potentially hamper it (Çetin et al., 2021). The majority of Chinese university soccer coaches place a strong emphasis on training while ignoring or even failing to comprehend the detrimental effects of exercise addiction on the development of players' skills. This could be a factor in why players' competitive levels do not sig-

nificantly increase over time despite the high intensity and high caliber of training.

OLS regression analysis showed that exercise identity, exercise beliefs, and sports participation motivation were predictors of exercise addiction in high-level college soccer players. Individuals with strong self-identities tend to act according to the behavior prescribed by this identity; therefore, players with high exercise identity devote a lot of time to training and competition as a way to express and substantiate their athletic identity to gain psychological benefits and self-esteem. However, individuals who seek positive emotions and self-esteem in this way tend to develop a dependence on training and competition, which raises the possibility of developing an exercise addiction. Exercise belief is a negative psychological tendency in which an individual believes that not exercising will have a harmful effect. When individuals with strong exercise beliefs miss exercise, their negative affect increases, which leads them to participate in exercise to reduce or eliminate the negative affect (Berczik et al., 2012; Hamer & Karageorghis, 2007). The stronger the player's exercise beliefs, the stronger the perception of the bad consequences of not exercising, the more dependent he or she will be on exercise, and thus the more likely she or he will develop an exercise addiction. Finally, high sports participation motivation is associated with the formation of exercise addiction, and studies have shown that motivation to compete, gain status, and release energy are associated with the formation of exercise addiction (Juwono, Tolnai, & Szabo, 2022; Conesa, Plaza, & Palacios, 2017). Individuals motivated by skill acquisition for exercise participation are less likely to develop exercise addiction behaviors compared to those who exercise to change their mood and improve their self-esteem (Egorov & Szabo, 2013).

After controlling for other variables, gender had a substantial impact on exercise addiction: male high-level soccer players were more likely to develop sports addiction behaviors than female players. The gender differences in player exercise addiction may be due to the differences in self-identity between male and female players. The traditional Chinese view of gender roles, which is still accepted by a significant portion of the population, holds that engaging in highly competitive, aggressive activities is a way to fully embody the male identity, while the opposite is true for women (Barron et al., 2004, p. 246; Ding, 2019; Wan, 2022). Gender stereotypes in Chinese colleges have had a significant negative impact on the growth of female soccer (Gao, 2021). Soccer is a highly competitive and aggressive sport; consequently, males influenced by traditional views of gender roles are more likely to internalize a soccer player identity as a self-concept. As strong exercise identity is associated with the development of exercise addiction, male players are more likely

to develop exercise addiction than female players. Additionally, there are far fewer female high-level college soccer teams than male high-level college soccer teams in China (Fig. 2). Female soccer tournaments in China are not as organized or regulated as male soccer, with lighter tournament schedules, fewer competitive options (Xu, 2013), and a weaker competitive culture (Ma, 2020). Compared to male soccer, female soccer is taken much less seriously, which makes women’s training and even exposure to soccer rare. Coupled with the imperfect tournament system and poor soccer atmosphere, women’s interest in soccer is lower than that of males, and women’s risk of exercise addiction is naturally lower.

Based on OLS regression, conditioned process analysis integrated mediation and moderation factors to examine how exercise identity, exercise beliefs, and sports participation motivation play a role in exercise addiction and how psychological effects vary by gender. First, exercise identity has a direct effect on the formation of exercise addiction. Second, exercise identity indirectly influences the formation of exercise addiction by affecting medi-

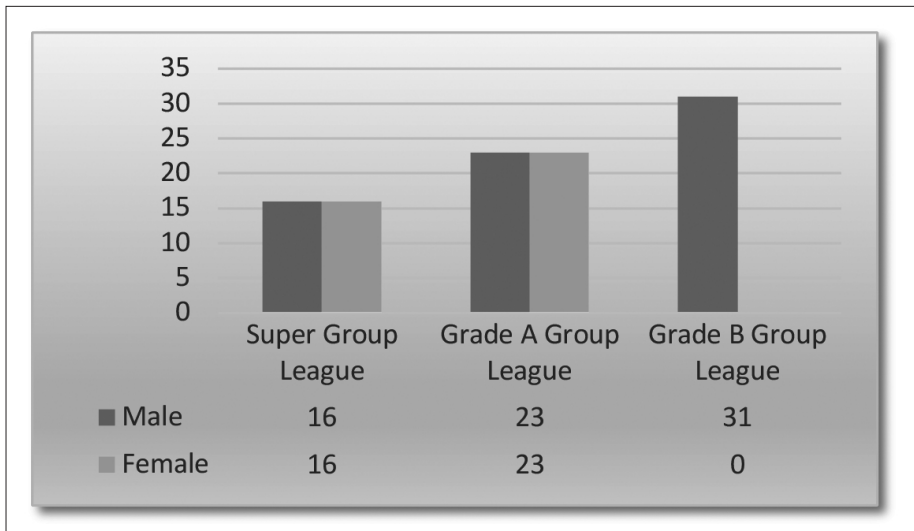


Fig. 2. - Male and Female Teams in the CUFA in 2021⁴

⁴ CUFA: _Chinese University Football League Official Portal. (n.d.; in Chinese). <http://www.cufa-china.cn/#team>.

ating variables—exercise beliefs and sports participation motivation. Third, gender has a moderating influence on the effect of exercise identity on exercise beliefs; male athletes' exercise identities had less of an impact on their exercise beliefs than female athletes' identities had on theirs. As previously discussed, high-level Chinese college soccer players have a high rate of exercise addiction, so prevention and treatment of exercise addiction should be taken seriously. This study found that high exercise identity is a key predictive factor in the formation of exercise addiction. However, while exercise identity is a factor in the formation of exercise addiction, it is also associated with an increased competitive level in athletes (Tasiemski et al., 2004; Palermo & Rancourt, 2019). In the face of this correlation, focusing on the psychological mechanisms of the formation of exercise addiction provides ideas for the prevention and treatment of exercise addiction: targeting the mediating variables of exercise beliefs and sports participation motivation in interventions. This study suggests prevention and treatment strategies for exercise addiction through influencing exercise beliefs are especially important for female soccer players due to gender's moderating effect on exercise identity's effect on exercise beliefs. This result also suggests avenues for future prevention or treatment of exercise addiction in female high-level college soccer players. According to previous studies, education-based interventions can effectively prevent and treat exercise addiction (Adams, 2009). Based on this study's results, educational interventions can include broadening players' knowledge about the hazards of exercise addiction and its formation mechanisms as well as offering athletes tailored courses and lectures on sports psychology and sports training, so that players can put sports participation in proper perspective, understand the hazards of exercise addiction, and build awareness of their own sports at a cognitive level, thus eliminating players' undesirable exercise beliefs, guiding players to clarify their college goals and life values, and establishing healthy motivation for sports participation (Li & Niu, 2017). Eliminating negative exercise beliefs and fostering health motivation for sports participation among high-level college soccer players through educational interventions may be a useful strategy to promote the overall development of this group. Future research on educational intervention is needed to better understand the possibilities.

Limitations

This article is a first-of-its-kind study on exercise addiction among high-level soccer players in Chinese colleges. However, there are limitations

to this study. First, though comparing the results of the current study with previous studies provides a useful frame of reference, it is impossible to draw a rigorous conclusion that collegiate athletes are more likely to develop exercise addiction than amateur sports groups, as different sports may be responsible for producing different rates of addiction. In order to eliminate errors brought on by differences in sports and solidify the correlation between the exercise addiction rates of these two types of exercise groups, follow-up studies should compare the sports addiction rates of high-level athletes participating in the same sport with those of amateur athletes. Secondly, regression is a correlational analysis that presupposes causality (Li, 2017, pp. 153-154), so this research methodology cannot verify a causal relationship between exercise identity, exercise beliefs, sports participation motivation, and exercise addiction. In addition, there is a risk of endogenous bias in the estimation of the results derived from the regression analysis. For example, omitted variable problems and two-way causation problems all lead to an increased risk of estimation bias (Huang, Fang & Wang, 2017). Future studies should use causal identification strategies such as the Regression Discontinuity or Instrumental Variable Method and so on to investigate the psychological factors of exercise addiction formation.

Conclusion

Exercise addiction, as an extreme exercise behavior, seriously affects individuals' physical and mental health, daily life, and work. A high prevalence of exercise addiction is found among high-level college soccer players in China, with almost 3 in 10 players displaying such tendencies. In this group, exercise identity, exercise beliefs, and sports participation motivation are valid predictors of exercise addiction. Conditional process analysis revealed that exercise beliefs and sports participation motivation mediated the effect of exercise identity on exercise addiction, and gender moderated the degree and direction of the effect of exercise identity on exercise beliefs. Improving high-level college soccer players' exercise beliefs and motivation to participate in sports by means of education is a feasible option to prevent and treat exercise addiction in Chinese educational institutions. Future studies could investigate the causal association between exercise addiction and psychological factors using causal identification tactics like matching methods and instrumental variable methods in light of the limitations of this study's research methodologies.

APPENDIX A.
Revised Version of the Participation Motivation Questionnaire

Athletes respond to the prompt: "I participate in sports because..."	
Factor	Item
Achievement/Status	To be popular
	Others to notice me
	To be important
	To receive ribbons and trophies
Teamwork	Because I like the coach
	Because I like the team spirit
	Because I like being on a team
	Because I like the team work
Fitness	To get in shape
	To stay in shape
	To exercise
Emotion	Because I like the excitement
	To release frustrations
	To get rid of energy
Competition	To compete
	The challenge
Skill development	To learn new skills
	To improve my skills
	To compete at higher level

APPENDIX B.
KMO and Bartlett's test

KMO		0.886
Bartlett's sphericity test	Approximate cardinality	4276.893
	Degree of freedom	171
	Significance	<.001

Appendix B shows that the KMO value of 0.886, with an indicator statistic greater than 0.800; the χ^2 value of Bartlett's sphericity test is 4276.893, reaching the .01 significant level. Acceptable validity has been shown among college high-level soccer players for the revised PMQ.

APPENDIX C.
Reliability of Measurement Instruments

Scale	Cronbach's alpha coefficients	Reliability
EAI	0.63	Moderate
EIS	0.91	Very high
EBQ	0.97	Very high
R-PMQ	0.92	Very high

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