EFFECTS OF EXERCISE DEPENDENCE ON PSYCHOLOGICAL HEALTH OF CHINESE COLLEGE STUDENTS

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SUMMARY

Background: The aim of this study was to investigate the effects of exercise dependence on the psychological health of Chinese college students.

Subjects and methods: A total of 1601 college students from three universities in Hunan, China, were selected as research subjects. Several measurement scales, including the Exercise Addiction Inventory, the State-Trait Anxiety Inventory, the Center for Epidemiologic Studies Depression Scale, and the Subjective Well-being Scale, were used to survey the psychological health problem of these students and to analyze the effects of exercise dependence on their psychological health.

Result: Exercise dependence, based on the structural equation model analysis, can positively influence state anxiety (P<0.05), depression (P<0.05), and subjective well-being (P<0.05) of Chinese students. By contrast, exercise dependence negatively influences students' self-satisfaction (P<0.05), social behavior (P<0.05), and vigor (P<0.05).

Conclusion: Exercise dependence adversely affects the psychological health of college students. Further research using multi-dimensional exercise addiction scales should be conducted to identify all the negative effects of exercise addiction factors on psychological health.

Key words: *exercise dependence - psychological health – depression – anxiety - college students*

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INTRODUCTION

With the rapid development of society and economy, the importance of physical exercise for physical and psychological health has gradually infiltrated into the heart of the masses. As an important part of a healthy lifestyle, physical exercise has generally been accepted by people and has become a part of their daily routine or habit (Li & Ma 2011). Regular exercise is beneficial to the physical, psychological, and social health of a person (Taghian et al. 2014, Soundy et al. 2015). However, some scholars are perplexed by the effect of exercise dependence caused by excessive exercise. Veale (1987) indicates that some individuals highly depend on exercise and consider it important in their daily life. When these people, who may be considered "exercise addicts," stop their routine, they may experience withdrawal symptoms similar to those of substance addicts, including insomnia, anxiety, anorexia, and testiness. This condition is the reason why some people refuse to stop exercising even temporarily although they are already suffering from exercise injury. Consequently, this circumstance may worsen the injury of these individuals (Veale 1987).

Hausenblas & Downs (2002, 2004) describe exercise addiction in accordance with the standard definition of substance dependence stipulated in the 4th version of the Diagnostic and Statistical Manual of Mental Disorders and then prepare the exercise dependence scale (EDS). This scale evaluates exercise dependence in terms of seven aspects, namely, tolerance, abstinence symptom, lack of control, intention effect, time, reduction of other activities, and persistence. Terry et al. (2004) introduce the exercise addiction inventory (EAI), which easily and accurately measures exercise addiction through six items. The most representative and popular scales used for exercisers include EDS and EAI, which both exhibit good validity and reliability. Some researchers have indicated that exercise addiction has high morbidity. For example, Anderson et al. (1997) explain that 22% of runners suffer from exercise addiction. This result agrees with the report of Slay et al. (26% morbidity) (Slay et al. 1998). Modolo et al. (2011) investigate athletes involved in different types of sports and determine that 28% of amateur and professional football players succumb to exercise addiction. These researchers also find that 32% of amateur players of other types of sports may be considered exercise addicts (Modolo et al. 2009). Li et al. (2012) report that symptoms of exercise addiction have been observed among 8.4% of the college student exercisers involved in their study.

College students are considered the future of a state and the hope of a nation. However, they experience psychological problems because their ideology is not yet fully developed, and they still lack psychological adjustment and anti-setback capabilities (Mark et al. 2011). Psychological problems affect the sound

development of college students. With the continuous economic development and the growing popular support for exercise and fitness, exercise dependence is becoming a psychological and behavioral problem, which should be addressed immediately (Li et al. 2012).

Psychological health is an important constituent of human health. The 3rd International Conference on Psychological Health held in 1946 defined psychological health (Chen & Tu 2011) as a "means to remain consistent with the psychology of others in terms of intelligence, body, and emotion as well as to develop one's mood to the optimal state." Mentally healthy individuals manifest the following characteristics: their intelligence, mood, and body work harmoniously; they are mutually humble in environment adaptation and interpersonal relationship; they have a satisfactory well-being; they give full play to ability and level; and they live an efficient life (Yang et al. 2005). The fundamental condition of psychological health is "no psychological illness." As negative emotional states, anxiety and depression are among the major problems that affect the psychological health of college students (Sun et al. 2007). Evren et al. (2011) posit that anxiety and depression are the main factors that worsen quality of life. Kanner (2005) asserts that anxiety and depression adversely affect the social functions of an individual, curtail his/her interpersonal communication, and reduce his/her interest in work and life. The worst-case scenario is that a person may commit suicide when he/she suffers from severe anxiety or depression. Subjective well-being (SWB) is an index for measuring the psychological health level of an individual. People with high SWB are considered psychologically healthy. These individuals come of age in a positive manner and experience "peak experience," a concept proposed by Maslow, through which they easily reach the stage of "self-actualization" (Ji & Li 2006, Cazan & Truta 2015). The present study adopts anxiety, depression, and SWB as the psychological health indicators of the research subjects and discusses the effect of exercise dependence on their psychological health to provide a theoretical basis for further cognizing, knowing, and studying the concept of exercise dependence.

Many researchers believe that exercise dependence negatively affects psychological health. However, only a few systematic domestic and overseas studies have looked into the effect of exercise dependence on psychological health. Furthermore, no study has yet explored the effect of exercise dependence on the psychological health of college students. Hence, the current study discusses the effect of exercise dependence on the psychological health of college students and analyzes the correlation of such dependence with their anxiety, depression, and SWB. This study provides a theoretical basis for researchers to know, cognize, and examine exercise dependence further, and thus, formulate corresponding therapeutic schedules.

SUBJECTS AND METHODS

Participants

College students from three universities in Hunan, China (i.e., Hunan University of Science and Technology, Xiangtan University, and Central South University) were selected as the research subjects. These students are members of physical exercise clubs (e.g., basketball club, volleyball club, football club, badminton club, dance club, aerobics club, martial art association, tennis association, etc.), exercise representative teams (e.g., basketball team, football team, track and field team, badminton team, etc.), and physical education class in their respective schools. Moreover, these students include regular exercise in their daily routine (continuous exercise exceeds 1 month, once per week). A total of 1689 questionnaires were distributed to the subjects, but only 1621 questionnaires were collected. In addition, 20 ineffective questionnaires were excluded from the analysis, and thus, 1601 effective questionnaires were used. The effective rate was 94.79%. The research sample comprised 617 females and 984 males aged 19 to 22 years.

Measures

(1) Exercise Addiction Inventory (EAI) (Terry et al. 2004): this tool consists of six questions and adopts a five-point Likert scale for scoring (i.e., 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree). The total score that may be obtained for this inventory ranges from 6 to 30. Terry et al. stipulate that when EAI $\geq$ 24, the subjects exhibit exercise dependence; when the score varies between 13 and 23, the subjects exhibit exercise dependence symptoms; when the score ranges from 0 to 12, the subjects do not display exercise dependence symptoms. That is, the exercise dependence symptoms of the subjects are severe when they attain a high EAI score. The Cronbach's reliability coefficient of the scale is 0.84 and its test–retest reliability is 0.86. The content, structure, and discrimination validities of EAI are good. Moreover, this scale exhibits favorable validity and reliability (Li & Ma 2011, Terry et al. 2004).

(2) State-trait Anxiety Invenotry (STAI) (Spielberger 1966): STAI can evaluate the state and trait anxieties of individuals. This definitive instrument consists of two sub-inventories and contains a total of 40 items. The first 20 questions comprise the state anxiety inventory (S-AI), which includes 10 items that describe negative mood and 10 items that describe positive mood. The remaining 20 questions constitute the trait anxiety inventory (T-AI) that is used to evaluate the frequent emotional experience of individuals. STAI uses a four-point Likert scale as the scoring method; each item is scored from 1 to 4. The positive mood items are reversely scored, and the total scores of S-AI and T-AI are separately calculated. The highest and lowest scores

that can be achieved for this scale are 80 and 20, respectively. These scores reflect the degree of state or trait anxiety. A low score implies a low anxiety level. The correlation coefficient of T-AI ranges from 0.73 to 0.86 and that of S-AI varies between 0.16 and 0.62. Moreover, the consistency, convergence, differentiation, and structure of this inventory are satisfactory, and it can efficiently evaluate the anxiety degree of a person (Wang et al. 1999).

(3) The Center for Epidemiological Studies Depression Scale (CES-D) (Radloff 1977) Wang et al. 1999): Numerous domestic and overseas studies have proven the applicability of this scale to teenagers. The measurement contents of CES-D include depression mood, positive mood, somatic symptom, and interpersonal relationship difficulty. CES-D contains 20 questions, 4 of which are reverse scoring questions. For this scale, the subjects are required to use 0–3 scores to evaluate the frequency of symptom occurrence for the previous week. The total score for this scale ranges from 0 to 60, and the demarcation point is generally 16. Subjects who attain a score of less than 16 have no depression mood, those with a score of 16 to 19 may have depression mood, and those with a score exceeding 20 certainly have depression mood. The internal consistency reliability, split-half reliability, and test–retest reliability of CES-D are 0.90, 0.77, and 0.67, respectively. This inventory exhibits favorable criterion validity (Wang et al. 1999).

(4) SWB (Ji & Li 2006): This scale is composed of 8 dimensions, i.e., self-satisfaction (10 items), negative mood (3 items), life satisfaction (7 items), social behavior (5 items), energy (4 items), positive mood (5 items), interpersonal relationship (4 items), and family satisfaction (3 items), for a total of 41 items. This scale employs a five-point Likert as its scoring method, i.e., 1 (complete inconformity) to 5 (complete conformity). The internal consistency coefficient and test–retest reliability of SWB are 0.937 and 0.864, respectively. The criterion validity, structure validity, and confirmatory factor analysis (CFA) show that the validity of this scale is good (Ji & Li 2006).

This study was conducted in Changsha and Xiangtan Cities in Hunan, China from October to December 2013. The questionnaires were distributed to college students in three universities in Hunan. A total of 1689 questionnaires were distributed, but only 1621 questionnaires were collected. After 20 ineffective questionnaires were discarded, 1601 effective questionnaires remained for further analysis. The research subjects included 984 males (61.5%) and 617 females (38.5%) aged 19 to 22 years.

Statistical Analysis

Statistical method: The SPSS 15.0 statistical software was adopted. The quantitative data were expressed with mean ± standard deviation. The inter-group comparison of the two groups of quantitative data adopted the independent samples t-test, and the correlation analysis of these quantitative data used Pearson correlation analysis. The inter-group comparison of the two groups of qualitative data adopted the chi-square test, and the influencing factor analysis used the multiple-stepwise logistic regression analysis.

RESULTS

As mentioned earlier, 1689 questionnaires were issued to the respondents, but only 1621 questionnaires were returned. In addition, 20 ineffective questionnaires were discarded; thus, 1601 effective questionnaires were used for analysis. The effective rate was 94.79%. Among the 1601 subjects, 984 were males (61.5%) and 617 were females (38.5%). Moreover, among the subjects, 150 were 19 years old (9.4%), 787 were 20 years old (49.2%), 352 were 21 years (22%), and 312 were 22 years old (19.5%). In terms of body type, 194 of the subjects were underweight (BMI < 18.5) (12.1%), 1054 had a normal body type (BMI: 18.5–24) (65.8%), 272 were overweight (BMI: 24–27) (17%), and 81 were obese (BMI ≥ 27) (5.1%) (Table 1).

Table 1. General information about study subjects

		numbers	%
Gender	male	984	61.5
	female	617	38.5
Age	19	150	9.4
	20	787	49.2
	21	352	22.0
	22	312	19.5
BMI	<18.5	194	12.1
	18.5-23.9	1054	65.8
	24.0-26.9	272	17.0
	≥27	81	5.1

Terry et al. (2004) specify that an EAI score greater than or equal to 24 indicates that the subjects have exercise dependence. Among the 1601 subjects in this study, 181 obtained a score greater than or equal to 24. The detection rate of exercise dependence was 11.3%.

Comparative analysis of anxiety, depression, and subjective well-being of college students with and without exercise dependence

Table 2 shows that in terms of state anxiety, the score of the exercise dependent group is greater than that of the non-exercise dependent group, with a statistical significance of t=4.67, P<0.001. By contrast, the difference between the two groups in terms of trait anxiety has no statistical significance (t=0.66. P=0.511). In the aspect of depression, the score of the exercise dependent group is greater than that of the non-exercise dependent group, with a statistical significance of t=35.73, P<0.001. In the aspect of subjective well-being, the scores of the exercise dependent group in self-satisfaction, social behavior, and energy are lower

Table 2. Comparative analysis of anxiety, depression, and SWB of college students with and without exercise dependence

| Scale | Dimension | Whether exercise dependence | | t | P |
		Yes (n=181)	No (n=1420)		
Anxiety	State anxiety	49.0±14.4	44.5±11.7	4.67	0.000
	Trait anxiety	45.3±10.7	45.8±10.6	0.66	0.511
Depression	Depression	33.0±11.9	11.3±7.0	35.73	0.000
Subjective well-being	Self-satisfaction	31.7±8.0	40.3±6.0	17.40	0.000
	Negative mood	12.5±2.6	10.6±2.6	9.36	0.000
	Social behavior	16.5±5.0	19.4±4.1	8.82	0.000
	Energy	12.1±4.3	14.6±3.5	8.89	0.000
	Life satisfaction	25.3±5.1	25.1±6.1	0.33	0.745
	Positive mood	18.2±4.4	18.0±4.5	0.48	0.633
	Family satisfaction	8.9±3.2	8.7±3.3	0.66	0.511
	Interpersonal relationship	14.4±3.7	14.4±3.7	0.00	0.999

than those of the non-exercise dependent group. The difference has a statistical significance (P<0.001). The score of the exercise dependent group in negative mood is higher than that of the non-exercise dependent group, with a statistical significance of t=9.36, P<0.001. Nonetheless, the difference between the two groups has no statistical significance (P>0.05) in terms of life satisfaction, positive mood, family satisfaction, and interpersonal relationship.

Pearson correlation analysis

Table 3 demonstrates that exercise dependence positively affects the state anxiety, depression, and negative mood of the study subjects (P<0.05), whereas self-satisfaction, social behavior, and energy have a negative effect (P<0.05). By contrast, exercise dependence does not incur significant effects on trait anxiety, life satisfaction, positive mood, interpersonal relationship, and family satisfaction (P>0.05).

Structural equation model analysis

The model graph for the effects of exercise addiction on the anxiety, depression, and SWB of the subjects was
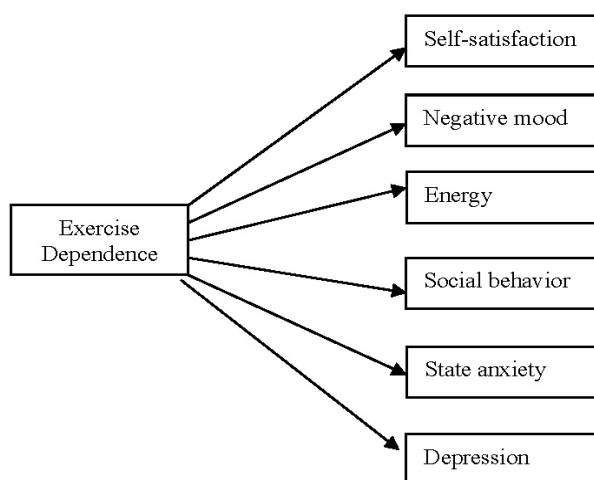
preliminarily constructed according to the relevant analysis results. AMOS 7.0 statistical software was adopted to fit the model in Figure 1 and Figure 2 shows the standardization coefficient of each path.

Table 3. Correlations of exercise dependence with the anxiety, depression, and SWB among research subjects

Dimension	Correlation coefficient (r)	P
State anxiety	0.230	0.000
Trait anxiety	0.008	0.742
Depression	0.459	0.000
Self-satisfaction	-0.450	0.000
Negative mood	0.325	0.000
Life satisfaction	0.040	0.114
Social behavior	-0.296	0.000
Energy	-0.309	0.000
Positive mood	0.006	0.823
Interpersonal relationship	-0.018	0.478
Family satisfaction	0.025	0.318

Figure 1. Model of the effects of exercise addiction on anxiety, depression, and SWB
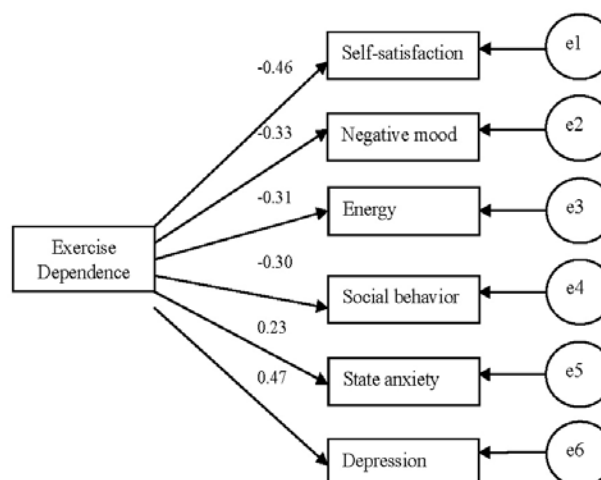

Figure 2. Structural equation model graph (standardization coefficient)

Table 4. Inspection results of each path coefficient

			Non-standardization coefficient	S.E.	C.R.	P	Standardization coefficient
Self-satisfaction	<--	Exercise addiction	-0.545	0.027	-20.169	***	-0.455
Negative mood	<--	Exercise addiction	0.154	0.011	13.723	***	0.329
Energy	<--	Exercise addiction	-0.202	0.016	-13.001	***	-0.31
Social behavior	<--	Exercise addiction	-0.224	0.018	-12.412	***	-0.300
State anxiety	<--	Exercise addiction	0.495	0.052	9.451	***	0.231
Depression	<--	Exercise addiction	0.838	0.041	20.656	***	0.466

Note: *** means P<0.001

Table 5. Fitting results of equation model

Indicator	χ^2/df	GFI	RMSEA	AGFI	CFI	IFI	PNFI	PGFI
Standard	<3	>0.90	<0.08	>0.90	>0.90	>0.90	>0.50	>0.50
Numerical in this study	2.81	0.991	0.039	0.983	0.932	0.932	0.648	0.531

Figure 1 presents the drawn hypotheses:

H1: Exercise addiction negatively influences self-satisfaction,

H2: Exercise addiction positively influences negative mood,

H3: Exercise addiction negatively influences energy,

H4: Exercise addiction negatively influences social behavior,

H5: Exercise addiction positively influences state anxiety,

H6: Exercise addiction positively influences depression.

Table 4 presents the inspection results of each path coefficient, which has a statistical significance.

The maximum likelihood method was employed to evaluate the fitting of the scale. The evaluation indexes of CFA are in accordance with the suggestion of Hou (2004). Multiple indexes were used for comprehensive evaluation. For the absolute fit indexes, χ^2/df, goodness-of-fit index (GFI), and root mean square error of approximation were adopted; for the relative fit indexes, adjusted GFI, comparative fit index, and incremental fit index were used; for the parsimonious fit indexes, parsimonious GFI and parsimonious normed fit index were employed. Table 5 shows that each index in this study is within the specified range. Consequently, the indexes of the research model properly fit the observation data.

Therefore, six hypotheses (i.e., H1 to H6) were established. In summary, these assumptions stipulate that exercise addiction positively affects the state anxiety, depression, and negative mood of the study subjects (P<0.05), but negatively affects their self-satisfaction, social behavior, and energy.

DISCUSSION

This study determines that the scores of the exercise dependent group are greater than those of the non-exercise dependent group in state anxiety and depres-

sion. Moreover, the correlation analysis shows that exercise dependence is positively correlated with the state anxiety and depression of the students. This observation indicates that exercise dependence positively affects the anxiety and depression of college students, but is not related to their trait anxiety. Anxiety is an expression of awakened mind and body functions under a stress state. Anxiety degree varies among individuals because of diverse stimuli or pressures. Moreover, the duration of anxiety also varies because of individual differences (Zhu et al. 2011). Anxiety makes a person cower, excessively obey, rage, or feel afraid. Excessive anxiety affects the academic achievements of a student and even his/her personality development. If one experiences anxiety for a long time, then his/her psychological state will generate various obstacles and impose severe effects on his/her physiology and behavior (Kanner 2005). In addition, the person may develop an anxiety disorder. The negative effect of anxiety cannot be ignored. Depression is a psychological disorder whose main feature is depression mood. The most severe effect of depression is suicide, which is the second largest cause of death among individuals aged 20 to 35 years. Among suicide death factors, 50% is depressive disorder. A survey shows that depression generates a high death rate. Approximately 15% to 20% of patients with depression commit suicide (Lisa et al. 2012). Therefore, social function problems related to mental disease have drawn the attention of scholars in recent years. In fact, several studies have aimed to investigate the cases of depressed patients. The interpersonal communication and social role functions of patients with depression are damaged, and such damage is continuous (Ma et al. 2011). Although people with depressive symptoms do not always suffer from depression, patients with depressive disorders undoubtedly exhibit depressive symptoms. Moreover, severe and lasting depressive symptoms may result in depression (Lisa et al. 2012). Some individuals with depressive symptoms do not receive relevant diagnostic criteria, but their quality of life is reduced because of depressive symptoms and

mood; these individuals also belong to the high-risk group of individuals with depression (Lisa et al. 2012). College students, who are in an important stage of life, do not only experience learning pressure, but also employment pressure. These individuals are in a stage in which the occurrence and period of depression are high. This study shows that exercise dependence can increase the depression mode of college students. If exercise dependence is not treated for a long time, and college students remain depressed because of academic pressure, employment pressure, and exercise dependence in the long term, then severe consequences may result. Considerable research has verified that exercise can relieve depression. For example, the works of Warburton et al. (2006), Fahey et al. (2007), and Donatelle et al. (2011) show that regular exercise is beneficial for the physiological, psychological, and social health of people. In the present study, however, the depression score of college students with exercise dependence is greater than that of students with non-exercise dependence. Moreover, this study realizes that exercise dependence is significantly related to and positively influences depression. These observations indicate that excessive exercise facilitates depression and influences psychological health. These findings also support the research results of Silvana et al. (2011), who discuss the correlation between depression and exercise dependence, and determine that the depression of exercise addicts is obviously higher than that of non-exercise addicts. These researchers also verify the argument of Veale, that is, exercise dependence results in various physiological and psychological disorders, including anxiety and depression (Veale 1987).

The research results also show that exercise dependence can positively influence negative mood in SWB, but can negatively affect self-satisfaction, social behavior, and energy. This finding entails that exercise dependence can generate negative mood, which reduces self-satisfaction and social behavior. This finding also implies that exercise dependence can lead to the excessive consumption of energy, which can cause a person to feel that he/she has insufficient energy. At present, an increasing number of people believe that SWB is an important indicator for evaluating psychological health condition, and that well-being promotion should be the main goal in improving psychological health level (Kim et al. 2014). Previous research confirms that exercise can improve well-being. For example, Thayer (1989) discovers that a 10-minute walk can result in energy abundance and relief of tension and fatigue for the next 2 hours (Ren & Ye 2006). Maroulakis & Zervas (1993) determine that after performing exercises for 1 hour, their research subjects generally felt that they are full of energy for the day; moreover, their tension, annoyance, depression, anger, and fatigue are reduced (Chen & Tu 2011). Hills & Argyle (1998) apply the Oxford Happiness Inventory to investigate individuals who frequently exercise, watch

TV, go to church, and listen to music, and those who nearly do not take part in these activities. The results show that the happiness of those who exercise frequently is significantly higher than those without frequent exercise (Hills & Argyle 1998). However, the result of the current study indicates that the scores of college students with exercise dependence is lower than those of students without exercise dependence in terms of self-satisfaction, social behavior, and energy. Moreover, the scores of the students with exercise dependence in terms of negative mood are higher than those of students without exercise dependence. The difference is statistically significant. The correlation analysis also reveals that exercise dependence is negatively correlated with self-satisfaction, social behavior, and energy, but positively correlated with negative mood. This finding shows that exercise dependence can reduce SWB. This observation is consistent with the research results of Silvana et al. (2011) that the depression of exercise addicts is obviously higher than that of non-exercise addicts, which supports the argument of Veale (1987). SWB can be used to assess the quality of life of a person, including his/her psychological health condition and development level. Based on the aforementioned findings, exercise dependence does not only reduce the quality of life of college students, but also influence their psychological health level. Thus, further studies should explore exercise dependence and provide additional measures and therapeutic schedules for exercise dependence.

CONCLUSIONS

This study analyzed the effects of exercise addiction on the anxiety, depression, and SWB of college students. The results show that exercise dependence is positively related to the anxiety and depression of the participant students. Exercise dependence influences negative mood in SWB and negatively affects self-satisfaction, social behavior, and energy. Moreover, the results verify that exercise addiction is a psychological problem. This study offers a basis for researchers to cognize and explore exercise addiction further. However, this study only uses the single-dimensional exercise addiction scale. Therefore, further research using multi-dimensional exercise addiction scale should be conducted to identify the negative effects of exercise addiction factors on psychological health.

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