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Effects of Fitness Dance and Funny Running on Anxiety of Female Ph.D. Candidates

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Abstract: Anxiety has been widely prevalent among female Ph.D. candidates. There is a positive correlation between exercise and mental health promotion. Nevertheless, little is known about the use of fitness dance and funny running to intervene in the anxiety of female Ph.D. candidates. In this paper, the effects of fitness dance and funny running on the anxiety of female Ph.D. candidates were evaluated by a repeated measurement experimental design. We randomly divided the participants into two groups, one group received a fitness dance exercise, and the other received a funny running exercise. The Spielberger State–Trait Anxiety Inventory was used to investigate the female Ph.D. candidates' anxiety. Repeated measures ANOVA was used to test the effects of a fitness dance group and a funny running group on participants' anxiety, and to compare the differences between the two groups. Results showed that a 12-week fitness dance and funny running can alleviate participants' anxiety from severe to moderate. Specifically, fitness dance increased the positive emotional experience of participants' state anxiety ($p = 0.018$) and trait anxiety ($p = 0.019$) at 8-week, and decreased the negative emotional experience of state anxiety ($p = 0.012$), trait anxiety ($p = 0.008$), state anxiety level ($p = 0.001$) and trait anxiety level ($p = 0.034$) at 12-week. Funny running increased the positive emotional experience of participants' state anxiety ($p = 0.014$), and trait anxiety ($p = 0.002$), and reduced the negative emotional experience of state anxiety ($p = 0.043$), state anxiety level ($p = 0.047$) and trait anxiety level ($p = 0.022$) at 12-week. This study suggests that fitness dance and funny running are healthy behaviors, which can help Chinese female Ph.D. candidates to dissociate from anxiety and stress situations and develop a healthy lifestyle. It is worth noting that the effects of fitness dance on Chinese female Ph.D. candidates' anxiety are better than that of funny running. Based on the good effects of fitness dance in alleviating the anxiety of Chinese female Ph.D. candidates, future researches can design fitness dance intervention programs combining exercise therapy and psychotherapy according to the anxiety characteristics of female Ph.D. candidates, such as mindfulness fitness dance programs.

Keywords: fitness dance; funny running; female Ph.D. candidates; anxiety

1. Introduction

Mental health problems run through life. The research work of Ph.D. candidates is an important part of scientific and technological progress and social development. Evidence showed that mental health problems have an impact on individual research output [1]. It has been reported that some Ph.D. candidates dropped out of school and gave up academic research completely due to mental health problems [2]. A survey on the mental health of 6320 Ph.D. candidates from 109 countries in the world published in Nature (2019) showed that 36% of them had anxiety of varying degrees, and female Ph.D. candidates face more anxiety [3]. Anxiety is a complex emotional state and unpleasant emotional state associated with tension, worry, and uneasiness that may cause a feeling of danger or threat [4]. A study showed that long-term dedication to academia makes

Ph.D. candidates feel more negative emotions and stress than common people [5]. Anxiety is closely related to stress. Compared with other fields, scientific researchers face more stress and their anxiety is more prominent [6]. Especially for Ph.D. candidates, the acquisition of the doctoral degree requires them to dedicate time, energy, and financial resources, such as publishing academic papers and dissertations [7,8]. Among them, the anxiety of female Ph.D. candidates is particularly prominent [9–12]. Many female students commit time and energy to meet scholar requirements and support their families, whether as wives or mothers. The combined stress derived from both roles leads to more anxiety [13].

The intervention of anxiety includes drug intervention, psychological intervention, and exercise intervention. In recent years, large numbers of studies showed that, physical exercise is negatively correlated with anxiety [14]. Studies pointed out that the positive emotions generated in the process of physical exercise can reduce the emotional susceptibility of individuals, promote individuals to face stress and difficulties more easily, and encourage individuals to face life with a positive attitude [15]. When individuals participate in physical exercise, if they can be aware of their emotions without reaction, they may improve their emotional regulation, and then alleviate anxiety [16]. Empirical studies showed that, compared with people who do not exercise often, those who often take part in physical exercise showed fewer negative emotions [17,18]. An empirical study confirmed that regular group walking has a positive impact on individuals, improving happiness and reducing negative emotions [19]. An empirical study found that exercise has the same effects of relieving depression as an antidepressant [20]. A systematic review indicated that participating in physical exercise can obviously improve the self-efficacy of emotion regulation [21]. The main forms of exercise intervention for anxiety are aerobic exercise, resistance exercise, and meditation exercise [22,23]. Empirical research showed that exercise combined with music has better effects on improving mental health [24–27]. Listening to music is good for the cognition, emotion, physiology as well as social well-being of an individual [28]. From the physiological point of view, music is involved in regulating arousal levels, including the effects on heart rate, skin electrical activity, and cortisol [29,30]. These effects may be related to the physical aspects of music [31]. Previous studies have shown that positive experiences in fitness dance, such as vitality, social relationships, and positive emotions may be important factors in promoting mental health [32–35]. Funny running has the functions of eliminating negative emotions, improving psychological adaptability, and promoting the development of psychological quality [36].

Based on previous studies, alleviating female Ph.D. candidates' anxiety has been a hot research topic at present. However, it has not been proven that fitness dance with music elements can relieve the anxiety of female Ph.D. candidates. Fitness dance promotes health, improves aesthetic ability, and enriches social and cultural life by using gymnastics movements and dance elements accompanied by music. Funny running has the characteristics of humor and activity, and exercise games are added to the organizational form. It includes three elements, running, games and intelligence competition. Consequently, this study assumes that fitness dance and funny running can alleviate female Ph.D. candidates' anxiety. In addition, the comparison of the effects of the two intervention programs on alleviating anxiety is also the focus of this study. A two-way repeated measurement design was adopted. Groups of fitness dance and funny running were set up. The "State anxiety-positive emotion", "State anxiety-negative emotion", "Trait anxiety-positive emotion" and "Trait anxiety-negative emotion" of the two groups at baseline, 8-week and 12-week were measured respectively. The differences of anxiety between the two groups were compared. This paper provides new empirical data for fitness dance and funny running to intervene the Chinese female Ph.D. candidates' anxiety.

2. Materials and Methods

2.1. Participants

Eighty-six anxious Chinese female Ph.D. candidates from Northeastern University are the participants of this study. In the process of recruiting participants, the Spielberger State–

Trait Anxiety Inventory was used to screen their anxiety. Participants with a score of more than 40 on the State Anxiety Inventory or on the Trait Anxiety Inventory, were considered to meet the requirements. In this way, non-anxiety of them were eliminated. The participants' age is 30.48 ± 5.69. Most of them are unmarried and childless, and their grades are evenly distributed. Previous research work of our group found that grade has a significant impact on female Ph.D. candidates' anxiety [6]. Therefore, the experimental design of this paper took the grade of the participants as the district group. Then, participants were assigned to two groups randomly. There are 43 participants in the fitness dance group and 43 participants in the funny running group. Specific information is shown in Table 1. The fitness dance group received 40-min of moderate intensity fitness dance training twice a week for 12 weeks. The funny running group received 40-min of moderate intensity funny running training twice a week for 12 weeks. After interventions, there are 38 participants in the two groups, respectively. Reasons for losing 10 participants included poor compliance (4), business trip (2), refusal to investigate (1), heavy learning task, and withdrawal from practice (3). The study was conducted after being approved by the ethics committee of Beijing Sport University (approval no.: 202203-15).

Table 1. Comparison of basic information between two groups of participants (*n* = 86).

Essential Information	Classification Criteria	Frequency (*n* = 86)	Fitness Dance Group (*n* = 43)	Funny Running Group (*n* = 43)	χ2	*p*
Age	20–25 years old	10	4(9.30)	6(13.96)	0.191	0.532
	26–30 years old	50	28(65.11)	25(58.13)		
	31–35 years old	24	10(23.26)	11(25.58)		
	36–40 years old	2	1(2.33)	1(2.33)		
Marital status	Unmarried	69	37(86.04)	32(74.42)	0.583	0.386
	Married	17	6(13.96)	11(25.58)		
Motherhood	No	78	41(95.34)	37(86.04)	0.096	0.745
	Yes	8	2(4.66)	6(13.96)		
Grade	Grade 1	20	10(23.26)	10(23.26)	0.000	1
	Grade 2	22	11(25.58)	11(25.58)		
	Grade 3	24	12(27.91)	12(27.91)		
	Grade 4	20	10(23.26)	10(23.26)		
Subject	Social science	29	16(37.21)	13(30.23)	0.382	0.518
	Natural science	32	12(27.91)	20(46.51)		
	Engineering and Technical Science	25	15(34.88)	10(23.26)		

2.2. Instruments

The Spielberger State–Trait Anxiety Inventory (STAI) was used to investigate the female Ph.D. candidates' anxiety. The State Anxiety Inventory (SAI) consists of 20 items, which are scored from 1 ("not at all") to 4 ("very much") according to the four-point Likert scale. It measures the individual's transient emotional reaction to a stressful situation and assesses anxiety, tension, emotional reactions to tension, and fear associated with how people feel "now" in stressful situations. The Trait Anxiety Inventory (TAI) consists of 20 items, which are scored from 1 ("almost never") to 4 ("almost always") according to the four-point Likert scale. Participants rated statements based on their current feelings (state) or overall feelings (trait). It measures the individual's tendency, which depends on her personality, and estimates how a person feels generally. Both of the two subscales have a range of 20–80, and have a well-established criterion, construct validity, and internal consistency reliability coefficients [37,38]. The internal consistency of the Chinese state (Cronbach's alpha = 0.91) and trait (Cronbach's alpha = 0.88) items was excellent [39]. Many studies showed that the SAI and TAI have good reliability and validity [40–43]. In view of

the psychometric characteristics predetermined by the survey tools, the construct validity and reliability were not diagnosed in this study.

2.3. Procedures

The two groups received exercise for 12 weeks from May to July 2022. The interventions were administered at baseline, 8-week, and 12-week. The instrument was the Spielberger State–Trait Anxiety Inventory.

2.4. Statistical Analysis

SPSS 21.0 statistical software was used to analyze the data. The basic information of the participants was analyzed by frequency analysis and Chi-square test. In order to test whether the data is normality, the Kolmogorov–Smirnov test was used to test the normality of the sample population ($n = 86$), Shapiro–Wilk test was used to test the normality of the fitness dance group ($n = 43$) and funny running group ($n = 43$). The differences between the two groups which affected the anxiety of female Ph.D. candidates were evaluated and compared by the Analysis of Variance (ANOVA). Repeated measures ANOVA was used to evaluate whether fitness dance and funny running can alleviate female Ph.D. candidates' anxiety, and to compare the effects of the two intervention programs on alleviating anxiety. According to the analysis results, the effects of the two intervention programs on the female Ph.D. candidates' anxiety were evaluated.

3. Results

3.1. Basic Information of Participants

There was no difference in the basic information between the two groups ($p > 0.05$, Age = 0.532, Marital status = 0.386, Motherhood = 0.745, Grade = 1, Subject = 0.518) by the Chi-square test. They were comparable. Specific information is shown in Table 1. Results of the normality test showed that (Table 2), the sample population and the two groups of samples were close to a normal distribution ($p > 0.05$). The data can be analyzed by ANOVA.

Table 2. Test of normality of samples ($n = 86$).

Variable	Total ($n = 86$). D p		Fitness Dance Group ($n = 86$). W p		Funny Running Group ($n = 43$). W p	
SAI	0.074	0.39	0.962	0.217	0.961	0.203
TAI	0.053	0.856	0.981	0.751	0.972	0.437
SAI-Positive emotion	0.069	0.498	0.954	0.116	0.94	0.053
SAI-Negative emotion	0.074	0.393	0.95	0.086	0.945	0.059
TAI-Positive emotion	0.069	0.487	0.973	0.467	0.954	0.117
TAI-Negative emotion	0.069	0.503	0.961	0.212	0.969	0.358

3.2. Comparison of Baseline Balance of Anxiety Emotion between Two Groups of Participants

The baseline anxiety emotion of female Ph.D. candidates in the two groups is shown in Table 3. Results of ANOVA showed that, there was no difference between them in the variables of "State anxiety-positive emotion", "State anxiety-negative emotion", "Trait anxiety-positive emotion", and "Trait anxiety-negative emotion" ($p > 0.05$). They were comparable.

Table 3. Comparison of baseline balance of anxiety emotion between two groups of participants (M ± SD).

Anxiety Emotion	Fitness Dance Group (*n* = 43)	Funny Running Group (*n* = 43)	F	*p*	$\eta^2{}_p$
SAI-Positive emotion	3.16 ± 0.29	3.22 ± 0.22	1.407	0.239	0.022
SAI-Negative emotion	2.73 ± 0.35	2.73 ± 0.27	0.001	0.972	0.018
TAI-Positive emotion	3.16 ± 0.25	3.13 ± 0.17	0.206	0.651	0.027
TAI-Negative emotion	2.85 ± 0.21	2.85 ± 0.26	0.008	0.928	0.041

3.3. Comparison of Baseline Balance of Anxiety Level between the Two Groups

Table 4 shows the baseline anxiety level of female Ph.D. candidates in the two groups. Results of ANOVA showed that there was no difference in the state anxiety score and trait anxiety score variables between the two groups ($p > 0.05$). They were comparable.

Table 4. Comparison of baseline balance of anxiety level between two groups of participants (M ± SD).

Anxiety Type	Fitness Dance Group (*n* = 43)	Funny Running Group (*n* = 43)	F	*p*	$\eta^2{}_p$
SAI	58.88 ± 5.36	59.51 ± 3.86	0.389	0.535	0.051
TAI	60.05 ± 3.85	59.88 ± 3.22	0.045	0.832	0.019

3.4. Effects of Fitness Dance on Female Ph.D. Candidates' Anxiety Emotion and Anxiety Level

Results of the anxiety emotion of the fitness dance group at each measurement time showed that (Table 5), after an 8-week intervention, the participants' "State anxiety-positive emotions" and "Trait anxiety-negative emotions" were significant ($p = 0.018$, $p = 0.019$). After a 12-week intervention, all the anxiety emotion was significantly lower than that of the baseline. Results of differences between 8-week and 12-week showed that all the anxiety emotion was significantly ($p < 0.05$).

Table 5. Anxiety emotion and level in fitness dance group at 8-week and 12-week.

Anxiety Emotion and Level	Baseline-*8-Week* t p		Baseline-*12-Week* t p		8-*Week*–12-*Week* t p	
Anxiety emotion						
SAI-Positive emotion	2.846	0.018 *	5.372	<0.000 **	3.073	0.023 *
SAI-Negative emotion	−1.894	0.061	−4.341	0.012 *	−2.152	0.032 *
TAI-Positive emotion	2.732	0.019 *	6.736	<0.000 **	2.967	0.017 *
TAI-Negative emotion	−2.442	0.052	−5.168	0.008 **	−2.832	0.046 *
Anxiety level						
SAI	−2.978	0.016 *	−5.228	0.001 **	−3.892	0.016 *
TAI	−0.048	0.999	−1.798	0.034 *	−2.29	0.017 *

* $p < 0.05$ ** $p < 0.01$.

Results of the anxiety level of the fitness dance group at each measurement time showed that (Table 5), after an 8-week intervention, the participants' state anxiety score was significant ($p = 0.016$). After a 12-week intervention, the participants' state anxiety score and trait anxiety score were significantly lower than that of baseline. Results of differences between 8-week and 12-week showed that all the anxiety level was significant ($p < 0.05$).

3.5. Effects of Funny Running on Female Ph.D. Candidates' Anxiety Emotion and Anxiety Level

Results of the anxiety emotion of the funny running group at each measurement time showed that (Table 6), there was no significant difference after a 8-week intervention.

After a 12-week intervention, the participants' "State anxiety-positive emotion", "State anxiety-negative emotion" and "Trait anxiety-positive emotion" were significant (p = 0.014, p = 0.043, p = 0.002). Results of differences between 8-week and 12-week showed that the participants' "State anxiety-positive emotion", "Trait anxiety-positive emotion", and "Trait anxiety-negative emotion" were significant (p = 0.041, p = 0.047, p = 0.032).

Table 6. Anxiety emotion and level in the funny running group at 8-week and 12-week.

Anxiety Emotion and Level	Baseline-*8-Week*		Baseline-*12-Week*		8-*Week*–*12-Week*	
	t	p	t	p	t	p
Anxiety emotion						
SAI-Positive emotion	0.468	0.062	2.575	0.014 *	1.682	0.041 *
SAI-Negative emotion	−2.162	0.085	−3.106	0.043 *	−1.832	0.113
TAI-Positive emotion	0.976	0.102	4.362	0.002 **	2.473	0.047 *
TAI-Negative emotion	−1.639	0.087	−2.015	0.057	3.421	0.032 *
Anxiety level						
SAI	−1.294	0.403	−2.303	0.047 *	−3.673	0.024 *
TAI	1.389	0.352	−2.414	0.022 *	1.818	0.037 *

* $p < 0.05$ ** $p < 0.01$.

Results of the anxiety level of the funny running group at each measurement time showed that (Table 6), there was no significant difference after the 8-week intervention. After the 12-week intervention, the participants' state anxiety score and trait anxiety score were significant (p = 0.047, p = 0.022). Results of differences between 8-week and 12-week showed that the participants' state anxiety score and trait anxiety score were significant (p = 0.024, p = 0.037).

3.6. Comparison between Fitness Dance and Funny Running on Female Ph.D. Candidates' Anxiety Emotion

As shown in Table 7, the results of time main effects showed that the "State anxiety-positive emotion" of the two groups was significant (F = 6.933, p = 0.001, η^2_p = 0.786) at different time points. The group's main effects were significant (F = 2.383, p = 0.004, η^2_p = 0.166). The interaction effects between time and group were significant (F = 1.775, p = 0.008, η^2_p = 0.274). Further simple effects analysis found that it was significant at 8 weeks (p = 0.001). The positive emotion of state anxiety in the fitness dance group was significantly higher than that in the funny running group. But it was not significant at 12 weeks (p = 0.142).

The time main effects of "State anxiety-negative emotion" of the two groups were significant (F = 7.983, p = 0.000, η^2_p = 0.403) at different time points. The main group effects were not significant (F = 0.26, p = 0.537, η^2_p = 0.192). The interaction effects between time and group were not significant (F = 0.17, p = 0.319, η^2_p = 0.124).

The time main effects of "Trait anxiety-positive emotion" of the two groups were significant (F = 3.197, p = 0.003, η^2_p = 0.829) at different time points. The main group effects were significant (F = 0.482, p = 0.037, η^2_p = 0.425). The interaction effects between time and group were significant (F = 2.698, p = 0.004, η^2_p = 0.343). Further simple effects analysis found that it was not significant at 8-week (p = 0.781), and it was significant at 12-week (p = 0.002). The positive emotion of trait anxiety in the fitness dance group was significantly higher than that in the funny running group.

The time main effects of "Trait anxiety-negative emotion" of the two groups were significant (F = 2.425, p = 0.003, η^2_p = 0.487) at different time points. The main group effects were significant (F = 0.306, p = 0.041, η^2_p = 0.071). The interaction effects between time and group were not significant (F = 0.085, p = 0.812, η^2_p = 0.049).

Table 7. Comparison of anxiety emotion changes between the two groups before and after intervention (M ± SD).

		SAI-Positive Emotion	SAI-Negative Emotion	TAI-Positive Emotion	TAI-Negative Emotion
Fitness dance group (*n* = 38)	Baseline	3.134 ± 0.281	2.716 ± 0.337	3.15 ± 0.233	2.85 ± 0.224
	8-week	2.89 ± 0.19	2.49 ± 0.32	2.88 ± 0.20	2.61 ± 0.19
	12-week	2.54 ± 0.17	2.18 ± 0.20	2.63 ± 0.16	1.98 ± 0.16
Funny running group (*n* = 38)	Baseline	3.189 ± 0.198	2.729 ± 0.262	3.132 ± 0.179	2.837 ± 0.268
	8-week	3.16 ± 0.16	2.69 ± 0.23	3.09 ± 0.17	2.71 ± 0.23
	12-week	3.03 ± 0.15	2.51 ± 0.22	2.96 ± 0.22	2.57 ± 0.21
Time	F	6.933	7.983	3.197	2.425
	p	0.001 **	<0.000 **	0.003 **	0.003 **
	η^2_p	0.786	0.403	0.829	0.487
Group	F	2.383	0.26	0.482	0.306
	p	0.004 **	0.537	0.037 *	0.041 *
	η^2_p	0.166	0.192	0.425	0.071
Time × Group	F	1.775	0.17	2.698	0.085
	p	0.008 **	0.319	0.004 **	0.812
	η^2_p	0.274	0.124	0.343	0.049

* $p < 0.05$ ** $p < 0.01$.

3.7. Comparison between Fitness Dance and Funny Running on Female Ph.D. Candidates' Anxiety Level

As shown in Table 8, the differences between the state anxiety score and trait anxiety score in the two groups were compared by ANOVA at different time points (baseline, 8-week, 12-week). Then the state anxiety score and trait anxiety score of participants were carried out by repeated measures ANOVA. Results showed that the time main effects of the "State anxiety score" of the two groups were significant (F = 5.425, p = 0.001, η^2_p = 0.638) at different time points. The group's main effects were significant (F = 2.878, p = 0.003, η^2_p = 0.487). The interaction effects between time and group were significant (F = 1.718, p = 0.007, η^2_p = 0.309). Further simple effects analysis found that it was significant at 8-week (p = 0.001) and 12-week (p = 0.042). The state anxiety level of the fitness dance group was lower than that of the funny running group.

Table 8. Comparison of anxiety level changes between the two groups before and after intervention (M ± SD).

		SAI	TAI
Fitness dance group (*n* = 38)	Baseline	58.88 ± 5.36	60.05 ± 3.85
	8-week	53.87 ± 4.22	54.95 ± 3.28
	12-week	47.26 ± 3.20	46.13 ± 2.13
Funny running group (*n* = 38)	Baseline	59.51 ± 3.86	59.88 ± 3.22
	8-week	58.58 ± 3.05	58.00 ± 2.97
	12-week	55.39 ± 2.76	55.37 ± 2.79
Time	F	5.425	0.081
	p	0.001 **	0.793
	η^2_p	0.638	0.009
Group	F	2.878	0.06
	p	0.003 **	0.433
	η^2_p	0.487	0.005
Time × Group	F	1.718	0.009
	p	0.007 **	0.825
	η^2_p	0.309	0.009

** $p < 0.01$.

The time main effects of the "Trait anxiety score" of the two groups were not significant (F = 0.081, p = 0.793, η^2_p = 0.009) at different time points. The group main effects were not significant (F = 0.06, p = 0.433, η^2_p = 0.005). The interaction effects between time and group were not significant, too (F = 0.009, p = 0.825, η^2_p = 0.009).

4. Discussion

In this study, fitness dance and funny running were used to intervene in the Chinese female Ph.D. candidates' anxiety. Results showed that fitness dance and funny running can both increase the positive emotional experience of state anxiety and trait anxiety of Chinese female Ph.D. candidates. They reduced the negative emotional experience of state anxiety and trait anxiety in female Ph.D. candidates, so as to alleviate their anxiety and reduce their anxiety levels. Both the two intervention programs are exercise programs. Empirical research showed that exercise plays a positive role in regulating attention orientation, improving cognitive function, and regulating emotional levels [44,45]. The positive emotions generated in the process of physical exercise have a positive impact on improving the subjective evaluation of stress, improving the negative cognition and negative emotions of individuals, and decreasing the duration and extent of the impact of stress events on individuals [46]. In addition, according to the information theory of emotion, positive emotion implies that there is no threat in the environment, which can expand the attention span of individuals and bring more positive judgments [47]. Negative emotions mark the emergence of some problems, and individual attention is directed and maintained on negative stimuli, prompting individuals to take careful and meticulous bottom-up processing to try to get rid of negative stimulus situations. A previous study suggested that training anxious individuals to focus on positive information can enhance positive emotional experiences [48]. If the attention center of anxious individuals is shifted from the attention to negative stimuli to other stimuli, the individual's attention bias can be properly corrected, so as to reduce the individual's anxiety level [49,50].

The 12-week intervention showed that the effects of fitness dance in alleviating female Ph.D. candidates' anxiety were better than those of funny running. According to the theory of embodied emotion, the reason why fitness dance is better than funny running may be related to embodied emotion [28,31]. The human body and its activity mode play important roles in the formation of emotions. Accompanied by music, fitness dance can mobilize more physical resources to participate in exercise through the physical activities of female Ph.D. candidates. The body motions of fitness dance are the unity of "body, mind, and spirit". The music of fitness dance integrates body motions into an emotional experience, endows female Ph.D. candidates with practice motivation, and touches them from emotion, imagination, and image [28,29]. The body motions of fitness dance act on the vision of participants in the form of space occupation. The music of the fitness dance acts on the hearing of participants in the form of sound. When female Ph.D. candidates practice fitness dance, they can focus on positive information such as body motion practice or exercise experience with music and dance. The increased positive emotional experience of female Ph.D. candidates can help them improve their level of the attention control system, inhibit negative attention bias reactions, and reduce their anxiety level. In addition, the embodiment of fitness dance makes anxious female Ph.D. candidates pull back from their academic anxiety experience and future worries and condense in the present. So that they can process perceptual information with body motions, provide cognitive content for the body with fitness dance motions, help them receive positive information in the environment, and increase their positive emotional experience.

This study indicated that the intervention time is an important factor affecting the effects of the two intervention programs on female Ph.D. candidates' anxiety. After the 8-week intervention, the participants' scores of "State anxiety-positive emotion", "Trait anxiety-negative emotion" and state anxiety level decreased significantly in the fitness dance group. But there was no significant change in the funny running group after the 8-week intervention. After the 12-week intervention, the scores of "State anxiety-positive emotion", "State

anxiety-negative emotion", "Trait anxiety-positive emotion", "Trait anxiety-negative emotion", state anxiety score, and trait anxiety score in the two groups were significantly lower than that of baseline. Moreover, the scores of the fitness dance group were significantly lower than those of the funny running group. The results showed that the intervention time has an important impact on the intervention effects. It may be due to the characteristics of exercise intervention itself, which requires a long enough intervention cycle to show its intervention effect [32,37]. It is worth noting that after an 8-week fitness dance intervention, the participants' positive emotions increased and their state anxiety score decreases. As well, the participants in the funny running group do not show significance after the 8-week intervention, but they show significance after 12 weeks. This result shows that the intervention cycle of fitness dance intervention is shorter and the effect is better than that of funny running intervention. However, there is no unified standard for the optimal duration and frequency of exercise to intervene in anxiety. The specific relationship between the minimum exercise dose and intervention time of fitness dance and funny running and the intervention effect remains to be further studied. Based on the good effects of fitness dance in alleviating the Chinese female Ph.D. candidates' anxiety, future researches can design fitness dance intervention programs combining exercise therapy and psychotherapy according to the anxiety characteristics of female Ph.D. candidates, such as mindfulness fitness dance programs.

It is worth pointing out that this study includes three research limitations. First, this study lacked of a control group to enhance the persuasiveness of the experimental results. Second, all data collected were from self-report, which may cause social desirability or reaction bias. Third, the female Ph.D. candidates' anxiety is related to their identity of wife or mother, but these variables were not involved in this study. We will take these variables into account in our next research. Future research direction may be to design more exercise intervention programs that are suitable for Ph.D. candidates to alleviate their anxiety and stress.

5. Conclusions

This study evaluated the effects of fitness dance and funny running intervention programs on anxious Chinese female Ph.D. candidates. The results showed that 12 weeks of the two intervention programs can alleviate the anxiety of Chinese female Ph.D. candidates from severe to moderate. It is worth noting that the effects of fitness dance had better effects on female Ph.D. candidates' anxiety than funny running. This study suggests that fitness dance and funny running are both good healthy behaviors, which can help anxious Chinese female Ph.D. candidates to dissociate from anxiety and stressful situations and develop healthy lifestyles.

This study confirmed the positive effects of fitness dance and funny running on Chinese female Ph.D. candidates' anxiety. This study enlightens us that exercise as a healthy lifestyle is a way to alleviate anxiety. More exercise programs for different people should be designed to alleviate anxiety and stress in future research.

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