ORIGINAL ARTICLE

Roles of State and Trait Anxiety in Physical Activity Participation for Adults with Anxiety Disorders

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Background/Purpose: Physical activity has benefits for reducing levels of anxiety. However, factors that affect physical activity participation for individuals with anxiety disorders have not been well studied. Here, we aimed to clarify the roles of state and trait anxiety in physical activity participation by examining relationships among seven major study variables in Taiwanese adults with anxiety disorders.

Methods: A multi-site, cross-sectional explanatory design was used. Data were collected using one interview and five self-administered questionnaires. The sample included 144 Taiwanese adults diagnosed with anxiety disorders.

Results: State and trait anxiety were significantly correlated with most of the study variables. Physical activity participation by subjects with anxiety disorders was significantly correlated with state anxiety, benefits of activity, self-efficacy for activity, and social support for activity. When age, sex, and education were controlled in the analysis, state anxiety was associated significantly and negatively with physical activity, benefits of activity, and self-efficacy for activity, and was correlated positively with barriers to activity. Trait anxiety was found to be correlated significantly and negatively with benefits of activity and self-efficacy for activity, and correlated positively with barriers to activity.

Conclusion: State anxiety demonstrated greater power than trait anxiety in its relationship with physical activity. These findings suggest that clinical mental health professionals should consider state anxiety when encouraging Taiwanese adults with anxiety disorders to engage in physical activity. [*J Formos Med Assoc* 2009;108(6):481–492]

Key Words: anxiety disorders, physical activity, state anxiety, trait anxiety

Physical activity has been shown empirically to have great benefits for physical health[1,2] and psychological functioning.[3,4] Healthcare providers increasingly recommend regular physical activity as an appropriate treatment to improve physical and psychological health for people with mental illness.[5] Individuals with anxiety disorders have been shown to have higher levels of state and trait

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anxiety than the general population.[6–8] These findings suggest key questions about the roles of state and trait anxiety as they relate to physical activity participation for Taiwanese adults with anxiety disorders.

The relationships between anxiety and behavior outcomes have been described in Spielberger's *Cross-Sectional Model of Anxiety*.[9] This model proposes that state anxiety causes behavioral reactions directly through defense mechanisms and adaptive processes to avoid stressful situations.[8,9] In addition, trait anxiety directly influences one's cognitive appraisal, which has an impact on how an individual perceives stressful situations.[9] This model led the authors to consider that state and trait anxiety may have a profound influence on physical activity behavior, especially for individuals with anxiety disorders.

Physical activity has been shown in a meta-analysis to help reduce levels of anxiety,[10] not only by its impact on biological systems,[11,12] but also by improving emotional status,[13] especially when exercise gives people relief and time away from daily worries.[14] These effects are profoundly significant for the moderate symptoms of individuals with generalized anxiety disorder (GAD) and panic disorder,[15] and participating in regular physical activity has been found to be especially meaningful and important for individuals with anxiety disorders.[16] Nevertheless, the motivation, facilitators and inhibitors of physical activity participation for individuals with anxiety disorders have not been fully documented. To promote better health for those with anxiety disorders, by encouraging them to engage in physical activity, the roles of state and trait anxiety need clarification. This is particularly true for Taiwanese adults with anxiety, because these issues have not been studied in this population.

This study was guided by Pender et al's[17] revised *Health Promotion Model* (HPM), which integrates constructs from Becker's *Health Belief Model*, Ajzen and Fishbein's *Theory of Reasoned Action*, Bandura's *Social Cognitive Theory*, and Prochaska and DiClemente's *Transtheoretical Model*. The revised HPM predicts health-promoting behavior, and has been tested for predicting physical activity in general populations.[13,18,19] Pender et al's revised HPM has been used to show that the physical activity of general populations is significantly affected by four factors: benefits of activity; barriers to activity; self-efficacy for activity; and social support for activity.[17] For example, physical activity in a Taiwanese general population was shown to be correlated positively with perceived benefits of activity in a sample of 400 workers,[20] which was also demonstrated in 125 US college students.[21] In addition, participation in physical activity was determined largely by self-efficacy for activity in both Western[4,22] and Taiwanese populations,[20] and influenced positively by social support for activity in general populations of adults from Western countries.[23–25] In contrast, barriers to physical activity have been shown often to hinder Taiwanese adolescents from engaging in physical activity.[26]

Together, these findings raise two key questions. Do these same four factors that influence physical activity for the general population correlate with participation in physical activity for people with anxiety disorders? Do state and trait anxiety also relate to these four factors and influence participation in physical activity? To help Taiwanese clients with anxiety disorders reduce anxiety levels, mental healthcare providers need additional evidence that state and trait anxiety are indeed related to levels of physical activity and factors that influence physical activity participation in this population.

Our objective was to clarify the roles of state and trait anxiety in physical activity participation of Taiwanese adults with anxiety disorders, by examining the relationships among seven variables: state anxiety, trait anxiety, levels of physical activity participation, benefits of activity, barriers to activity, self-efficacy for activity, and social support for activity. Our hypothesis was that increased levels of state and trait anxiety were associated significantly with decreased levels of physical activity participation, with decreased levels of benefits of activity, self-efficacy for activity, and social support for activity, as well as increased levels of barriers to activity.

Subjects and Methods

Research design and study subjects

A cross-sectional explanatory design was used to select a convenience sample from five study sites: three psychiatric clinics in the city of Taichung, one counseling center in Taoyuan County, and one psychiatric clinic in the city of Taipei. Criteria for selection included non-hospitalized men and women, aged 20–60 years, diagnosed with anxiety disorders by clinical psychiatrists, able to verbally communicate, and who agreed to participate in this study. Subjects meeting these criteria were identified by psychiatrists at the study sites using the Structured Clinical Interview from the *Diagnostic and Statistical Manual of Mental Disorders*.[27] Individuals were excluded if they were diagnosed with schizophrenia, mood disorder, impaired cognitive function, or physical disability.

The sample size was estimated using nQuery Advisor 6.01 (Statistical Solutions, Boston, MA, USA). This software calculated a sample size of 81–118 based on correlation coefficients between physical activity and six anxiety- and physical-activity-related variables found in a pilot study of 18 adults with anxiety disorders, a power of 0.80, $\alpha = 0.05$, and a two-tailed test of significance. Allowing for a 15% dropout rate, the total sample size needed was 135. Of the 150 individuals who participated in this study, 144 (96%) completed all questionnaires. The study sample included 72 patients with GAD, 48 with panic disorder and agoraphobia (PDA), 13 with obsessive-compulsive disorder (OCD), six with posttraumatic stress disorder (PTSD), and five with social phobia (SP). The final power for this study, based on correlation coefficients of six variables to physical activity, was 87–96%.

Instruments

Data for this study were collected using six instruments: the *Demographic Inventory* (DI), the *State-Trait Anxiety Inventory form Y* (STAI-Y), the *Exercise Benefits/Barriers Scale* (EBBS), the *Exercise Confidence Survey* (ECS), the *Social Support and Exercise Survey* (SSE), and the *Past Year Regular Physical Activity Checklist* (PYRPAC).

Measures of state anxiety, trait anxiety, self-efficacy, social support (STAI-Y, ECS, SSE) were translated from English into Mandarin Chinese and back-translated to satisfy both semantic and cultural equivalence requirements.[28,29] The measure of exercise benefits and barriers (EBBS) used for this study was translated previously from English into Chinese.[18] The measure of physical activity (PYRPAC) was modified by the authors from existing Chinese measures of physical activity to accommodate the cultural background and specific age range of the study subjects.

DI

Demographic data on study subjects included nine items: age, sex, education, marital status, job status, income adequacy, self-reported monthly income, anti-anxiety medication, and anxiety disorder diagnosis.

STAI-Y

State and trait anxiety were defined according to Spielberger.[8] State anxiety is the temporary dimension of anxiety that is related to stress responses, and trait anxiety is the character dimension of anxiety that is related to the long-term stability of personality. The STAI-Y is a self-administered questionnaire that measures subjective feelings of state and trait anxiety. The STAI-Y includes 40 items rated on a 4-point Likert-type scale from 1 (not at all) to 4 (very much). The STAI-Y has two subscales that assess state anxiety (Y1, 20 items) and trait anxiety (Y2, 20 items). Total STAI-Y scores can range from 40 to 160, with higher scores indicating higher anxiety. The two subscales have been shown to have satisfactory reliability and validity.[8] For the current research, the 2-week test–retest reliability of the Chinese version of the STAI-Y was shown, in a pilot study of 18 Taiwanese adults with anxiety disorders, to be 0.63 for state anxiety and 0.92 for trait anxiety. The lower reliability for state anxiety in the pilot study was likely explained by fluctuations in individuals' feelings with changing life events.[8] For the present study,

Cronbach's α coefficients were 0.92 and 0.90 for trait and state anxiety subscales, respectively.

EBBS

Benefits of activity have been defined as an individual's subjective knowledge or experience regarding the advantages of physical activity,[30] and barriers to activity as the perceived limitations to physical activity.[30] The EBBS has two subscales that measure benefits of activity (29 items) and barriers to activity (14 items). EBBS items are rated on a 4-point, forced-choice, Likert-type format scale from 4 (strongly agree) to 1 (strongly disagree). Scores on the benefits subscale can range from 29 to 116, and on the barriers (limitations) subscale from 14 to 56. Higher scores on the benefits subscale indicate more perceived benefits of exercise. Higher scores on the barriers subscale indicate more perceived barriers to exercise. The original EBBS was reported to have good 2-week test–retest reliability, internal consistency, and construct validity.[30] The Chinese version of the EBBS was reported to have good test–retest and internal consistency reliability.[18] In the pilot study for the current research, the 2-week test–retest coefficients for the Chinese version of the EBBS benefits and barriers subscales were 0.87 and 0.87, respectively. Cronbach's α coefficients for the benefits and barriers subscales in the present study were 0.92 and 0.84, respectively.

ECS

Self-efficacy for activity was defined as one's confidence in the ability to engage in physical activity.[31] The ECS measures self-efficacy for activity and consists of 12 items rated on a 5-point Likert-type scale from 1 (I know I cannot) to 5 (I know I can). ECS scores can range from 12 to 60, with higher scores indicating greater confidence in one's ability to engage in physical activity. The ECS was reported to have acceptable 2-week test–retest reliability, internal consistency reliability, criterion-related validity, and construct validity.[31] In the pilot study for the current research, the Chinese version of the ECS had a 2-week test–retest coefficient of 0.73. Cronbach's α coefficient for the present study was 0.90.

SSE

Social support for activity was defined as an individual's cognitive appraisal of being reliably supported by family members and friends when performing physical activity.[32] The SSE measures social support for activity during the preceding 3 months. The SSE consists of 13 items with responses rated on a 5-point Likert-type scale from 1 (none) to 5 (very often). Each item has two responses: one indicating support from family (or members of the subject's household) and the other indicating support from friends. SSE scores can range from 26 to 130, with higher scores indicating greater social support for performing physical activity. The SSE was reported to have good 2-week test–retest reliability, internal consistency reliability, criterion-related validity, and construct validity by principal-components factor analysis.[32] In the pilot study for the current research, the Chinese version of the SSE had a 2-week test–retest coefficient of 0.89. Cronbach's α coefficient for the present study was 0.89.

PYRPAC

The definition of physical activity for the present study was an individual's regular performance of moderate physical activity during the past year. The PYRPAC was modified from the 12-item *Past Year Regular Physical Exercise Questionnaire* (PYRPEQ), which has been used to measure regular leisure-time physical exercise for Taiwanese elders,[18] and from 19 physical activities identified as most likely to be performed by 504 Taiwanese adults.[33] Drawing on these studies, we added 13 items to the PYRPEQ and changed its format from self- to interviewer-administered to create the 25-item PYRPAC, plus three open-ended items at the end. The PYRPAC was then evaluated and found to measure accurately regular physical activity for Taiwanese adults with anxiety disorders.

To quantify the information collected in the PYRPAC, all data were recorded as energy expenditure, using metabolic equivalent units (METs). One MET is equal to 3.5 mL O_2/kg/min.[34] The METs for each physical activity were recorded as described previously.[35,36] Higher METs indicated

greater amounts of regular physical activity. In the pilot study for the current research, the PYRPAC had a 2-week test–retest coefficient of 0.70 and a correlation coefficient of 0.68 ($p < 0.001$) when compared with a 7-day physical activity recall.

Procedure and ethical consideration

The present study was approved by the Institutional Review Boards at the study sites. Subjects signed informed consent that explained the study purposes, data collection procedures, potential risks and benefits of participation, and protection of confidentiality by ensuring the anonymity of their responses. Potential risks for subjects included fatigue and anxiety or discomfort caused by the subject matter and length of the questionnaires. To minimize these risks, subjects were told that they could rest at any time, they were not pressured to complete the questionnaires within a time limit, and they could omit any items that made them feel uncomfortable.

Data were collected during July 2004 and July 2006 using interviewer- and self-administered questionnaires. To recruit subjects, the first author provided exclusion and inclusion criteria to the managers and staff members at the five study sites. Patients meeting the study criteria were identified by study-site psychiatrists who informed the authors. The researcher met with these potential participants in a quiet room to explain the study purposes and to describe the rights, benefits and risks of participation. After participants signed the consent form, the researcher gave them a copy of the consent form and a pack of questionnaires. Subjects were then interviewed individually by the researcher using the PYRPAC to measure levels of physical activity. The remaining questionnaires were then explained, and subjects completed them alone. Each subject took 25–60 minutes to complete the questionnaires.

Data analysis

Descriptive statistics were used to explain demographic data and major variables. Levine's test was used to examine the assumption of homogeneity of variance (HOV) among groups. Differences by study sites and by types of anxiety disorder were tested by analysis of variance (ANOVA) and Scheffe's test. Levine's test was used to examine differences among groups, and *post hoc* tests using Dunnett's *C* test were used to examine the data for variables that did not satisfy the HOV. Pearson's *r* correlation was used to test relationships among study variables for the two groups. Linear regression was used to examine relationships of state and trait anxiety to other study variables by controlling for age, sex and education.

Results

Subject characteristics

Of 144 Taiwanese adults in the study sample, 55 (38.2%) were male, and 89 (61.8%) were female. They had a mean age of 35.96 ± 10.79 years (range, 20–60 years), with 45.8% ($n = 66$) who were single and 43.8% ($n = 63$) who were married. One hundred and thirty-three subjects (92.3%) had completed a high school education. Eighty-two subjects (56.9%) reported adequate income to meet their needs, and only 55 (38.2%) were currently taking medicine to control anxiety. The average state and trait anxiety scores were 46.62 and 55.42, respectively. The details of these study variables are shown in Table 1.

Differences among subjects by type of anxiety disorder

Subjects with different types of anxiety disorders differed significantly with regard to state anxiety, trait anxiety, benefits of activity, and self-efficacy for activity (Table 2). *Post hoc* test outcomes showed that subjects with SP had significantly higher state and trait anxiety levels than subjects with other anxiety disorders. On the other hand, subjects with PDA showed significantly higher self-efficacy for activity than subjects with GAD and SP. Subjects with different types of anxiety disorder did not differ significantly in terms of physical activity participation, perceived benefits of activity, perceived barriers to activity, and social support for activity.

Table 1. Scales used to measure variables and their descriptive statistics ($n = 144$)

Variable	Scale	*n*	Mean	SD	IQR	Range
Age	DI	144	35.96	10.79	17.75	10–60
Education	DI	144	13.43	3.25	4.0	18
State anxiety	STAI-Y1	144	46.62	9.45	14	23–74
Trait anxiety	STAI-Y2	144	55.42	7.53	9.5	33–76
Benefits	EBBS-benefits	144	85.01	9.99	7.75	58–113
Barriers	EBBS-barriers	144	29.76	4.61	4	17–40
Efficacy	ECS	144	31.17	11.67	17.5	12–60
Social support	SSE	143	43.29	13.78	21	20–78
Physical activity	PYRPAC	144	23.52	21.16	18.8	0.39–127.69

IQR = 75th quartile minus 25th quartile; DI = demographic inventory; STAI-Y = State-Trait Anxiety Inventory form Y; EBBS = Exercise Benefits/Barriers Scale; ECS = Exercise Confidence Survey; SSE = Social Support and Exercise Survey; PYRPAC = Past Year Regular Physical Activity Checklist.

Correlations of physical activity participation with physical-activity factors and anxiety

Physical activity participation for subjects with anxiety disorders was correlated significantly with state anxiety, benefits of activity, self-efficacy for activity, and social support for activity (Table 3). In addition, state and trait anxiety were correlated significantly with most of the variables that influenced physical activity participation.

Linear regression analysis for state and trait anxiety by potential confounders

To clarify the role of anxiety in participation in physical activity, we used linear regression analysis to examine potential confounders between state anxiety and physical activity and factors that influenced participation in physical activity. When age, sex and education were controlled in the analysis, state anxiety was associated significantly and negatively with physical activity, benefits of activity, and self-efficacy for activity, and was correlated positively with barriers to activity. Table 4 presents detailed information about relationships between state anxiety and other variables when potential confounders were controlled.

Using a similar analysis as for state anxiety, trait anxiety was found to be correlated significantly and negatively with benefits of activity and self-efficacy for activity, and correlated positively with barriers to activity when age, sex and education were controlled. The results of linear regression analysis for trait anxiety by controlling for potential confounders are summarized in Table 5.

Discussion

Our results show that state anxiety had greater power than trait anxiety in its relationship with physical activity. State anxiety was correlated significantly and negatively with physical activity for our subjects with anxiety disorders, but trait anxiety was not associated significantly with physical activity. State anxiety, by definition,[8] is the response to stress from life events postulated to affect behaviors. It was reasonable to assume, therefore, that subjects with higher state anxiety would have engaged in less physical activity, because they faced problems or stresses in their lives. This assumption is supported by results of a 4-year follow-up study on 7281 young adult women whose physical activity levels decreased during key life events such as getting married and having children.[37]

In contrast, a 2-year randomized controlled trial[38] found that higher life stress was related to greater participation in physical activity among an intervention group of 184 women and 154 men. These results suggest that higher stress supports greater physical activity participation because physical activity is perceived as a way to help deal

Table 2. Differences among subjects with different types of anxiety disorders ($n = 144$)

Variable	Disorder type	*n*	Mean	SD	*F*	Scheffe's test
State anxiety	GAD	72	48.72	8.55	4.617*	SP, OCD†
	PDA	48	47.98	10.06		SP, PDA†
	OCD	13	47.92	8.15		SP, PTSD†
	PTSD	6	41.33	6.74		SP, GAD†
	SP	5	63.80	8.70		
Trait anxiety	GAD	72	54.82	7.09	5.094*	SP, PTSD†
	PDA	48	55.17	7.59		
	OCD	13	59.08	5.38		
	PTSD	6	48.17	7.94		
	SP	5	65.60	5.77		
Benefits	GAD	72	85.11	9.43	3.202†	No differences
	PDA	48	86.40	8.54		
	OCD	13	78.31	13.19		
	PTSD	6	92.50	9.22		
	SP	5	78.80	14.52		
Barriers	GAD	72	30.15	4.68	2.368	No differences
	PDA	48	29.33	3.99		
	OCD	13	30.08	4.48		
	PTSD	6	25.17	5.42		
	SP	5	32.80	6.14		
Self-efficacy	GAD	72	28.61	10.36	3.919*	PDA, SP†
	PDA	48	35.71	12.71		PDA, GAD†
	OCD	13	30.00	12.95		
	PTSD	6	35.50	5.79		
	SP	5	22.40	5.68		
Social support	GAD	71	43.29	13.78	0.930	No differences
	PDA	48	42.69	14.05		
	OCD	13	42.15	14.72		
	PTSD	6	53.50	10.86		
	SP	5	40.20	8.89		
Physical activity	GAD	72	22.21	21.97	1.368	No differences
	PDA	48	28.64	22.81		
	OCD	13	15.51	13.09		
	PTSD	6	18.33	10.91		
	SP	5	20.37	6.86		

*$p < 0.01$; †$p < 0.05$. *GAD = generalized anxiety disorder; PDA = panic disorder and agoraphobia; OCD = obsessive-compulsive disorder; PTSD = posttraumatic stress disorder; SP = social phobia.*

with life stress. Similarly, 32,229 employed adults who participated in moderate physical activity were about half as likely to perceive stress as those who did not exercise.[39] Coping skills for life stress may differ in working people or healthy young adults from those in individuals with anxiety disorders.

Our findings also showed that physical activity was correlated significantly and positively with study variables that influenced physical activity, i.e. the benefits of, self-efficacy for, and social support for physical activity. These outcomes are consistent with the predicted outcomes

Table 3. Pearson's *r* correlations of physical activity with selected variables for subjects with anxiety disorders ($n = 144$)

	Age	1	2	3	4	5	6	7
Education (1)	–0.46*							
State (2)	–0.07	–0.01						
Trait (3)	–0.15	–0.06	0.58*					
Benefits (4)	0.08	–0.05	–0.27*	–0.25*				
Barriers (5)	0.07	–0.01	0.29*	0.28*	–0.39†			
Efficacy (6)	0.19†	–0.11	–0.39*	–0.22*	0.41*	–0.36*		
Support (7)	0.05	0.05	–0.09	–0.16	0.26*	–0.25*	0.32*	
Physical activity	0.15	–0.03	–0.27*	–0.14	0.37*	–0.11	0.52*	0.25*

*$p < 0.01$; †$p < 0.05$.

Table 4. Summary of linear regression analysis for state anxiety by age, sex and education

Outcome variable	Control	β	Beta	t	Adjusted R^2	F
Physical activity	Beta	39.09		2.45*	0.09	4.66†
	State anxiety	–0.53	–0.24	–2.95†		
	Age	0.41	0.21	2.30*		
	Sex	–5.56	–0.13	–1.58		
	Education	0.34	0.05	0.59		
Benefits of activity	Beta	96.35		12.50‡	0.06	3.09*
	State anxiety	–0.29	–0.27	–3.33†		
	Age	0.03	0.04	0.38		
	Sex	1.75	0.09	1.03		
	Education	–0.09	–0.03	–0.32		
Barriers to activity	Beta	20.16		5.70‡	0.07	3.50†
	State anxiety	0.14	0.30	3.60‡		
	Age	0.05	0.12	1.27		
	Sex	–0.11	–0.01	–0.14		
	Education	0.07	0.05	0.56		
Efficacy for activity	Beta	55.63		6.74‡	0.21	10.21‡
	State anxiety	–0.43	–0.35	–4.58‡		
	Age	0.19	0.18	2.08*		
	Sex	–5.39	–0.23	–2.96†		
	Education	–0.14	–0.04	–0.46		
Support for activity	Beta	40.32		3.66‡	–0.01	0.56
	State anxiety	–0.12	–0.09	–0.99		
	Age	0.11	0.08	0.86		
	Sex	0.28	0.01	0.12		
	Education	0.35	0.08	0.87		

*$p < 0.05$; †$p < 0.01$; ‡$p < 0.001$.

of Pender et al's[17] revised HPM, except for the variable of barriers to activity. Our results are also supported by previous studies that have shown that physical activity is correlated significantly and positively with the benefits of activity,[21] and that the higher the perceived benefits of activity, the higher the levels of physical activity.[5,40] Other support comes from evidence that self-efficacy

Table 5. Summary of linear regression analysis for trait anxiety by age, sex and education

Outcome variable	Control	β	Beta	t	Adjusted R^2	F
Physical activity	Beta	29.24		1.52	0.05	2.75*
	Trait anxiety	–0.29	–0.10	–1.24		
	Age	0.43	0.22	2.35*		
	Sex	–6.85	–0.16	–1.91		
	Education	0.43	0.07	0.72		
Benefits of activity	Beta	101.07		11.08†	0.04	2.52*
	Trait anxiety	–0.33	–0.25	–2.97‡		
	Age	0.03	0.03	0.29		
	Sex	1.15	0.06	0.68		
	Education	–0.05	–0.02	–0.18		
Barriers to activity	Beta	16.68		4.02†	0.07	3.54‡
	Trait anxiety	0.18	0.30	3.62†		
	Age	0.06	0.13	1.42		
	Sex	0.17	0.02	0.23		
	Education	0.05	0.04	0.41		
Efficacy for activity	Beta	50.70		4.97†	0.12	5.78†
	Trait anxiety	–0.28	–0.18	–2.28*		
	Age	0.20	0.19	2.09*		
	Sex	–6.39	–.27	–3.37‡		
	Education	–0.07	–0.02	–0.23		
Support for activity	Beta	50.39		3.93†	0.00	1.11
	Trait anxiety	–0.28	–0.15	–1.78		
	Age	0.09	0.07	0.71		
	Sex	0.10	0.01	0.04		
	Education	0.36	0.09	0.91		

*$p < 0.05$; †$p < 0.001$; ‡$p < 0.01$.

and social support for activity are the most common factors that influence physical activity.[22,41] Our results also showed that state anxiety was related significantly to three of the four factors that influence physical activity. These results suggest that future studies might consider state anxiety as a cognitive variable for benefits of, barriers to, efficacy for, and support for activity in a model to predict physical activity. The results of model testing might fill gaps in our knowledge about direct and indirect influences on physical activity in patients with anxiety disorders.

We found that subjects with different types of anxiety disorders differed in most of the variables that we examined, which indicates that individuals with different types of anxiety disorders vary with regard to participation in physical activity. For example, subjects with PTSD had significantly lower levels of trait anxiety than others. In addition, subjects with SP had significantly higher state anxiety than others. To obtain more insightful and stable data, we suggest that future researchers select and group subjects based on similar types of anxiety. For example, subjects with GAD, PDA, OCD and SP should be grouped separately from those with PTSD for trait anxiety, and subjects with GAD, PDA, OCD and PTSD should be grouped separately from those with SP for state anxiety. When individuals with anxiety disorders are encouraged to engage in physical activity, those with GAD and SP need more interventions to increase self-efficacy for activity, since our study showed

that such individuals had significantly lower self-efficacy scores for activity than others did.

The results of this study showed a significant relationship between age and self-efficacy for activity. In addition, this result was compromised by the gender imbalance in our sample (two-thirds female). To determine whether other sociodemographic variables were confounders for anxiety variables, we controlled for these variables and other physical activity-related variables and found no change in the significant relationships of state and trait anxiety to other study variables. We also found that trait anxiety was associated significantly with benefits of, barriers to, and self-efficacy for activity. To test for direct and indirect effects of individual characteristics such as personal data and trait anxiety on physical activity behavior, future research should include a larger sample size.

Study limitations

The generalizability of our results has some limitations. First, the data were collected from Taiwanese adults, aged 20–60 years, who were receiving services in mental health clinics for anxiety disorders. Thus, our results may not be applicable to people younger than 20 or older than 60 years, living in other countries with different cultures, or with other mental diseases or disorders. Second, the information was obtained from questionnaires and interviews, which may have bias related to memory capacity, personal influences or opinions, and social desirability. Third, subjects were recruited by convenience sampling. Thus, outcomes cannot be generalized for individuals diagnosed with anxiety disorders who did not participate or who were attending other clinics. Fourth, this study is limited by using a cross-sectional design to explore relationships between anxiety, physical activity, and four factors that influence physical activity. Interpretation of results must be made cautiously, because an explanatory design explains only the most fundamental relationships among variables. To investigate better causality and changes in variables over time, a cohort study or experimental design should be used in future studies.

Relevance to clinical application

The wellbeing of individuals with mental illness is promoted by the World Health Organization,[42] and mental wellbeing has been associated with increased participation in physical activity. Physical activity is also correlated positively with psychological benefits, including a greater sense of well-being, absence of negative emotion during exercise, positive impression of physical status, and feelings of relaxation after activity.[21] Furthermore, physical activity is associated significantly with a decreased prevalence of anxiety disorders for individuals with mental illness.[16,43] For these reasons, mental health clinicians should develop guidelines to promote physical activity participation by first dealing with the higher levels of state and trait anxiety in populations with anxiety disorders.

When encouraging individuals with anxiety disorders to engage in physical activity, clinicians should also emphasize the benefits of activity (e.g. decreased anxiety levels), improve patients' self-efficacy for activity (e.g. conduct small groups in clinics for sharing successful experiences in regular physical activity), and develop social support for activity (e.g. help enlist family members or friends who can join subjects in the activity).

Here, perceived barriers to activity were not correlated significantly with physical activity. This outcome differed from that of other studies, in which barriers to activity were usually related negatively to physical activity.[44] Our findings on barriers to activity suggest that clinicians might not need to consider barriers when promoting increased levels of physical activity for people with anxiety disorders.

Conclusion

This is believed to be the first study to demonstrate correlations among state anxiety, trait anxiety, physical activity and factors that influence physical activity in Taiwanese adults with anxiety disorders. The results are consistent with previous reports that physical activity is correlated well with most of its influencing variables. This study

suggests that clinical mental health professionals should emphasize state anxiety when encouraging these clients to engage in physical activity.

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