

Regular Exercise and Depressive Symptoms in Community-Dwelling Elders in Northern Taiwan

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ABSTRACT

Background: According to World Health Organization, depressive disorder will be a Top 2 disease in the world by 2020. In light of Taiwan's rapidly increasing elderly population, elderly psychological health is expected to become an increasingly important issue in healthcare.

Purpose: This study examines the association between regular exercise and depressive symptoms in community-dwelling older adults by gender in northern Taiwan.

Methods: The participants were selected using a probability-proportional-to-size procedure from community-dwelling adults who were aged 65 years or older and living in northern Taiwan. A cross-sectional study and interviews were used to collect information about their exercise behaviors, depressive symptoms, and the factors influencing the depressive symptoms. Percentage, chi-square, *t* test, and logistic regression were used to analyze the data.

Result: One thousand twenty elderly individuals completed the questionnaires. Among the participants with the average age of 73.5 years, 44.5% were men, and 55.5% were women. Two hundred seventeen of the participants (21.3%) had depressive symptoms. Five hundred eighty-five of the participants (57.4%) exercised regularly. The result of logistic regression showed that regular exercise was a significant predictor of depressive symptoms in elderly individuals (odds ratio = 3.54, 95% confidence interval [1.76, 7.12]). Other factors such as gender, chronic diseases, and health status were not related to depressive symptoms. Moreover, both for male and female individuals, regular exercise was a significant predictor of depressive symptoms (odds ratio = 4.76, 95% confidence interval [1.65, 13.72] and odds ratio = 3.03, 95% confidence interval [1.18, 7.69], respectively). Other factors were not related to depressive symptoms.

Conclusions/Implications for Practice: This study shows regular exercise to be a significant predictor of depressive symptoms in both men and women. Therefore, senior citizens should be encouraged to exercise regularly as a way to promote good mental health.

KEY WORDS:

elderly, depressive symptoms, regular exercise, gender, Taiwan.

Introduction

Aging is a chronic condition of humanity that increases the morbidity and mortality of physical chronic illnesses such as cardiovascular disease, hypertension, diabetes mellitus, cancer, and mental illness. In 2002, the World Health Organization proposed the International Strategy for Action on Ageing to address the phenomenon of global aging. This plan focuses on three areas: developing aging, health promotion, happiness, and peace in the elderly population; assuring that the older adults are provided with assistance and support to maintain their health; and helping the older adults adapt to aging-related changes. One of the related strategies focuses on improving the psychological health of elderly populations (World Health Organization, 2012).

It is estimated that people aged 65 years and older will constitute 20% of the total population in Taiwan by 2025 (Health Promotion Administration, Ministry of Health and Welfare, 2012). As this segment of our society grows, there will be an urgent need to pay attention to these older people and to their physical, mental, and social health needs.

Depressive disorders are a critical health concern for the older adults. Between 1990 and 2010, disability adjusted life years (DALY) for depressive disorder increased 37.5%. In 2010, the proportion of depressive disorder was 3.0% (2.2%–3.8%) in 2.5 billion DALY cases, with major depressive disorder accounting for an average of 2.5% (1.9%–3.2%). Aging was identified as one cause of the higher rate of DALY (Ferrari et al., 2013).

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It is common to use depressive symptoms to examine mental health in community-dwelling elderly populations. Furthermore, various studies on the depressive symptoms among community-dwelling older adults have indicated a high prevalence of depressive symptoms. An 11%–44% incidence of depression has been found in the older adults in the United States (Blazer, Burchett, Service, & George, 1991; Pettit et al., 2008; Shim, Baltrus, Ye, & Rust, 2011). Similarly, a 21%–40% incidence of depression has been found in Taiwan (Lin, Chen, & Lin, 2010; Lin, Yang, & Yang, 2010; Lyu & Lin, 2000). The incidence of depressive symptoms identified among elderly people may vary because of differences in the tools used to measure depressive symptoms and because of differences in ethnic background.

Several factors were found to affect the occurrence of depressive symptoms in the older adults. The factors associated with a high incidence of depression were decreased daily activities, having chronic diseases, and being a woman. Furthermore, being less educated, being unemployed, and being a widow have been associated with elevated risk of depression (Aihara, Minai, Aoyama, & Shimanouchi, 2011; Greer & Trivedi, 2009; Helvik, Engedal, Krokstad, Stordal, & Selbæk, 2012; Lin, Chen, et al., 2010; Lin, Yang, et al., 2010; Pettit et al., 2008).

Several studies have shown a relationship between an inactive lifestyle and self-perceived happiness, self-respect, depressive symptoms, and quality of life (Barcelos-Ferreira et al., 2009; Barcelos-Ferreira, Lopes, Nakano, Steffens, & Bottino, 2012; Xue et al., 2012). However, few studies have assessed the relationship between regular exercise and depressive symptoms in the older adults.

Prior research has found preliminary evidence that a combination of physical activity (PA) and antidepressants helps reduce the symptoms of depression in depressive older adults (Mura & Carta, 2013) and in hospitalized older patients with heart failure (Verheijden Klompstra, Jaarsma, & Strömberg, 2014). However, these studies did not address the effectiveness of PA in decreasing depressive symptoms in community-dwelling older adults. Regular exercise is a low-cost health prevention strategy. If a relationship between regular exercise and depressive symptoms exists in the elderly population, health promotion through exercise programs may become more attractive to the general public.

Several studies have applied gender as an independent variable in the research design to examine the effect of this variable on results (Greer & Trivedi, 2009; Lin, Chen, et al., 2010; Lin, Yang, et al., 2010; Pettit et al., 2008). Furthermore, some studies have focused on the differences in prevalence of depressive symptoms and various signs of depressive symptoms among elderly men and women (Escobar Bravo, Botigué Satorra, Jürschik Giménez, Nuin Orrio, & Blanco Blanco, 2013; Forlani et al., 2014). In addition, other studies have discussed the impact of demographic characteristics (e.g., educational level, marital status) on the depressive-symptom-related health status of elderly men and women (Forlani et al., 2014; Jang, Kim, & Chiriboga, 2011). However, few studies have investigated gender differences in the relationship between regular exercise and depressive

symptoms. Therefore, this study examines the factors that affect the depressive symptoms of both genders.

This study was designed to address the determinants of depressive symptoms in community-dwelling older people and gender-based differences in these determinants. We hypothesized that demographic characteristics, health-related factors, and regular exercise affect the depressive symptoms of Taiwanese older adults. Moreover, demographic characteristics, health-related factors, and regular exercise affect depressive symptoms differently in elderly men and women.

Methods

Participants

A cross-sectional study was conducted to collect information about the exercise behaviors, depressive symptoms, and the factors influencing the depressive symptoms of elderly individuals. The participants were selected using a probability-proportional-to-size procedure from among the population of community-dwelling adults aged 65 years or older and living in northern Taiwan. Townships were the primary sampling unit, villages were the secondary sampling unit, and people were the basic sampling unit (National Health Research Institutes, 2001). Village heads provided the lists of potential participants. The main criterion for choosing prospective participants was age (65 years or older). Otherwise, qualified individuals who were unable to communicate orally were excluded. The ratio of elderly women to elderly men was 1.04 in Taiwan in 2011 (Civil Affairs Bureau, Taoyuan County Government, 2014). One thousand one hundred prospective participants (539 men and 561 women) were selected for recruitment, and 1020 joined the study and completed the interview process (response rate: 92.7%). Six interviewers conducted interviews, and interrater reliability was .90. Trained investigators conducted face-to-face interviews and collected the data from August to October 2011. The respondents accepted face-to-face interview from interviewers.

All participants agreed to take part in this research and signed informed consent. The Chang Gung Medical Foundation Institutional Review Board in Taiwan approved this study (No. Nor 98-4087B).

Instruments

Regular exercise and physical activity

Exercise includes planned, specific, and routine body movements that promote essential elements of physical fitness. Exercise routines conducted at least three times per week for at least 6 consecutive months were considered to be regular exercise. PA involves the contraction of skeletal muscles to produce body movement and raise energy expenditure (Wojtek et al., 2009). We asked the participants regarding their vigorous and moderately vigorous PA for the past week.

The questionnaire used in this study was based on Gionet and Godin's questionnaire sample and included two questions

that assessed regular exercise behaviors: (a) Have you exercised regularly during the past 6 months (maintained for 30 minutes, heart rate above 130 beats/minute, and sweat)? Yes or no? (b) If “yes,” how often do you exercise?

Gionet and Godin (1989) found the simple question of regular exercise to be significantly relevant to vigorous PA time. The relationship factor between self-report exercise behavior and a 12-minute walk-run test was .54 (Martin et al., 1984), which showed the validity of the simple self-reported exercise and supports that the use of self-reported regular exercise times and of vigorous PA times in this study were relevant. The test–retest reliability coefficients for self-reported regular exercise time were .92 after 2 weeks.

Vigorous PA includes running, mountain climbing, swimming, walking up stairs, aerobic exercise, fast bicycle riding, jumping rope, carrying heavy things, and shoveling dirt. The participants indicated the number of days during the past week that they performed vigorous PA and the duration of exercise for each time (only exercise sessions measuring more than 10 minutes were included). Participants who exercised for over 60 minutes during 1 week were considered as having completed vigorous PA.

Moderately vigorous PA includes moderate-speed swimming, dancing, riding a bicycle at a normal speed, carrying heavy materials or babies, yard/house work, playing tennis, playing baseball, and playing table tennis. The participants indicated the number of days during the past week that they had performed moderately vigorous PA and the duration of each exercise session that had lasted for more than 10 minutes. For walking exercise, participants indicated the number of days during the past week that they had walked and the duration of each exercise session that had lasted for more than 10 minutes.

Participants who performed moderately vigorous PA and walking exercises for over 150 minutes during the past week were considered to have performed moderately vigorous PA. Those participants who were not in the vigorous PA or moderately vigorous PA group were assigned to the inadequate PA group.

We used the self-administered short Chinese version of the International Physical Activity Questionnaire, with a content validity index of 0.992. Language equivalence and meaning similarity between the English and Chinese versions of the self-administered short International Physical Activity Questionnaire was 0.994, and the consistency value for the English and Chinese versions in terms of intraclass correlation coefficients was 0.704 (Liou, Jwo, Yao, Chiang, & Huang, 2008). The test–retest reliability coefficients for the self-reported vigorous PA and moderately vigorous PA were .82 and .85, respectively, after 2 weeks.

Depressive Symptoms

This study used the Center for Epidemiological Studies–Depression Scale (CES-D) to measure the degree of depressive symptoms in participants. Chien and Cheng (1985) found that the CES-D scale had satisfactory validity in Taiwan,

with a sensitivity and specificity of 92.0% and 91.0%, respectively, and a positive predictive value of 67.7%. The split-half reliability in this study was .91. That study used the brief self-report 10-item CES-D (range = 0–30), with items scored between 0 and 3 (0 = *never/rarely*, 1 = *sometimes*, 2 = *often*, 3 = *always*). Total scores of 8 or more are considered to indicate the presence of depressive symptoms (Lin, Yang, et al., 2010). The Cronbach’s α of the CES-D scale in the Chien and Cheng study was .81. A factor analysis found the three concepts of somatic symptoms, optimistic tendency, and disturbers of interaction.

Demographic Variables

The demographic variables considered in this study include gender, educational level, age, and marital status.

Health Status

The participants were asked: How do you feel about your health status? The percentages of participants who answered good, fair, or poor are presented in Table 1.

Chronic Disease

The participants were asked: Has a doctor ever told you that you have a chronic disease (e.g., heart disease, hypertension, diabetes mellitus)? The percentages of participants who answered yes or no are presented in Table 1. The variable was entered as a dichotomous variable (yes vs. no) in the logistic regression equations.

Data Analysis Strategy

The demographic variables are displayed as means and percentages. The gender-based comparisons of participant demographics (age, gender, marital status, educational level, and occupation), chronic disease status, health status, PA status, and regular exercise status were analyzed using a chi-square test for categorical variables and a Student’s *t* test for continuous variables.

The odds ratio (OR) of depressive symptoms for the related factors of chronic disease, health status, PA, and regular exercise used logistic regression that was adjusted for age, gender, marital status, occupation, and educational level. After controlling for the variables associated with depressive symptoms and regular exercise behavior, logistic regression analyses examined the main effect of PA and regular exercise on depressive symptoms. SPSS Version 18.0 was used to analyze the above data.

Results

Data on demographics, health-related behaviors, PA, and regular exercise are shown in Table 1. The mean age of the participants was 73.5 ($SD = 6.42$) years, with ages ranging from 65 to 88 years. Furthermore, 44.5% of the participants were men, and 55.5% were women, a high percentage were illiterate, most were married, over half reported their health status were good, and 585 (57.4%) self-reported as exercising regularly.

TABLE 1.
Demographic Characteristics and Health-Related Factors (N = 1,020)

Characteristic	n	%
Age (years): mean ± SD and min, max	73.5 ± 6.42 (65, 88)	
Gender		
Male	454	44.5
Female	566	55.5
Employed		
No	852	83.5
Yes	168	16.5
Education (years)		
0–6	799	78.3
≥7	321	21.7
Marital status		
Married	999	97.9
Other	21	2.1
Health status		
Good	574	56.3
Fair	361	35.4
Poor	85	8.3
Chronic disease		
No	533	52.3
Yes	487	47.7
Regular exercise		
No	435	42.6
Yes	585	57.4
PA		
Strenuous PA		
No	742	72.7
Yes	278	27.3
Moderate PA		
No	561	55.0
Yes	459	45.0
Shortness of PA		
No	576	56.5
Yes	444	43.5
CES-D scale		
≥8	217	21.3
<8	803	78.7

Note. PA = physical activity; CES-D scale = Center for Epidemiological Studies-Depression Scale.

Two hundred seventeen participants (21.3%) scored an 8 or higher on the CES-D, with this subgroup scoring particularly high in the realms of pessimistic tendency and disturbers of interaction.

As shown in Table 2, a gender-based comparison of variables found significant differences in terms of age, education, moderately vigorous PA, and inadequate PA.

An OR and logistic regression were performed to examine the influence on depressive symptoms of age, gender, educational level, marital status, chronic disease, health status, PA, and regular exercise. For depressive symptoms, a dichotomous outcome of depressed (CES-D ≥ 8) versus not depressed

(CES-D < 8) was developed. This variable was then used in the model as the dependent measure.

Regular exercise was the only factor significantly related to a lack of depressive symptom (OR = 3.54, $p < .000$), both for men and women (ORs = 4.76 and 3.03, $p < .000$ and $p = .02$, respectively). There were no significant differences found in other variables including demographic characteristics, health status, and PAs. The details of the logistic regression are shown in Table 3.

Discussion

Two hundred seventeen participants (21.3%) earned scores equal to or greater than 8, which indicated that these individuals had significant levels of depressive symptoms. This percentage is within the range of 21%–40% that was identified in previous studies of depressive symptoms in Taiwanese older adults (Lin, Chen, et al., 2010; Lin, Yang, et al., 2010; Lyu & Lin, 2000). This result is moderate compared with the results of 11%–44% reported by studies of community-dwelling older adults in the United States (Blazer et al., 1991; Pettit et al., 2008; Shim et al., 2011) and higher than that found for older adults in Japan (12.9%; Aihara et al., 2011).

This study suggests that elderly individuals who exercised regularly experience a lower prevalence of depressive symptoms. Participants who exercised regularly tended to have a lower risk of depressive symptoms than their peers who did not exercise regularly. This study showed comparable results with a cohort study conducted between 1984 and 1987 (Kritz-Silverstein, Barrett-Connor, & Corbeau, 2001). In the Alameda County Study, exercise was shown to prevent prevalent depression and incident depression in a large sample of 1,947 community-dwelling older adults (Strawbridge, Deleger, Roberts, & Kaplan, 2002). Aihara et al. (2011) found that physical exercise, a daily intake of well-balanced meals and milk products, and personal hobbies related significantly to the absence of depressive symptoms in elderly men and women in Japan. Some research suggests that exercise reduces depressive symptoms (Greer & Trivedi, 2009; Lin, Chen, et al., 2010; Lin, Yang, et al., 2010; Pettit et al., 2008). This study identified similar results.

In our study, no relationship was found between moderately vigorous PA, vigorous PA, and depressive symptoms during the immediately preceding week. This result differed from Reichert, Diogo, Vieira, and Dalacorte (2011). Two possible causes of this difference are as follows. First, our research categorized PA into moderately vigorous PA and vigorous PA. The criteria for the completeness of these two differed from Reichert et al.'s research, which categorized PA into three levels: insufficient, sufficient, and very active. Second, this study examined regular exercise, which was not included in Reichert et al.'s research and which may contribute to the different research findings.

This study found a significant association between regular exercise and depressive symptoms in community-dwelling older adults. The author first examined the regular exercise behavior of participants based on the total amount of time that

TABLE 2.
Demographic Characteristics and Health-Related Factors of Participants by Gender

Variable	Male (n = 454)		Female (n = 566)		p
	n	%	n	%	
Age (mean and SD)	75.92 ± 7.65		73.98 ± 6.75		<.001
Education (years)					
0–6	309	68.1	490	86.6	<.001
≥7	145	31.5	76	13.4	
Employed					
Yes (including part-time jobs)	77	17.0	91	16.1	.710
No	377	83.0	475	83.9	
Marital status					
Married	448	98.7	551	97.3	.140
Others	6	1.3	15	2.7	
Chronic disease					
Yes	212	46.7	275	48.6	.550
No	242	53.3	291	51.4	
Health status					
Good	261	57.5	313	55.3	.480
Fair and poor	193	42.5	253	44.7	
Regular exercise					
Yes	166	36.6	209	36.9	.910
No	288	63.4	357	63.1	
PA					
Vigorous PA					
No	326	71.8	416	73.5	.670
Yes	128	28.2	150	26.5	
Moderately vigorous PA					
No	274	60.4	287	50.7	<.050
Yes	180	39.6	279	49.3	
Shortness of PA					
No	240	52.9	336	59.4	<.050
Yes	214	47.1	230	40.6	
CES-D					
≥8	93	20.5	124	21.9	.590
<8	361	79.5	442	78.1	

Note. PA = physical activity; CES-D scale = Center for Epidemiological Studies-Depression Scale.

they exercised every week. Furthermore, the author applied three independent variables into the research: no exercise, not meeting the standard requirements of regular exercise, and regular exercise. The author examined whether these three variables affected depressive symptoms, with results indicating a significant effect only for regular exercise. Average duration and frequency of exercise were independent variables with no effect on depressive symptoms. However, lack of regular exercise affected depressive symptoms.

The many health benefits of exercise include improved vitality, improved physical fitness, improved psychological well-being, and improved quality of life (Conradsson et al., 2013; Goodwin, 2003; Lee & Hung, 2011; Phillips, 2015).

Regular exercise may play a very important role in the prevention of depressive symptoms in older people. The influence of level of exercise, however, remains uncertain. Future research

may include measurements of types of exercise, levels of exercise, and frequency. Randomized clinical trials may show a causal relationship.

In this study, bivariate statistics showed that the percentage of moderately vigorous PA among women was greater than that among men. Although a survey conducted by the Taiwan Health Promotion Administration found that elderly men had exercised more than women in the past 2 weeks (Health Promotion Administration, 2013), the present survey focused on duration of exercise rather than type of PA. Our study, however, included moderately vigorous PA time, average pace of exercises, housework, and time spent walking. Therefore, our research outcome differed from the survey conducted by the Health Promotion Administration.

This study attempted to assess the difference between men and women in terms of self-perceived depressive symptoms.

TABLE 3.
Logistic Regression of Depressive Symptoms by Gender (N = 1020)

Variable	Male		Female		All	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Age	1.00	0.97, 1.03	1.01	0.97, 1.04	1.00	0.98, 1.03
Regular exercise (no/yes)	4.76***	1.65, 13.72	3.03*	1.18, 7.69	3.54***	1.76, 7.12
PA						
Vigorous PA (no/yes)	1.58	0.65, 3.83	1.54	0.76, 3.13	1.47	0.85, 2.55
Moderately vigorous PA (no/yes)	2.18	0.85, 5.62	1.16	0.47, 2.84	1.57	0.83, 2.97
Shortness of PA(no/yes)	0.45	0.15, 1.36	0.80	0.29, 2.23	0.62	0.30, 1.30
Education (0–6/≥7 years)	0.91	0.53, 1.57	0.77	0.42, 1.42	0.86	0.57, 1.28
Employed (yes/no)	0.70	0.38, 1.30	0.94	0.54, 1.65	0.81	0.54, 1.22
Marital status (other/married)	1.85	0.31, 11.04	2.09	0.67, 6.50	1.98	0.77, 5.09
Chronic disease (yes/no)	1.04	0.64, 1.71	0.72	0.46, 1.10	0.86	0.62, 1.18
Health status (good/others)	1.13	0.64, 1.98	1.41	0.85, 2.36	1.27	0.88, 1.84

Note. PA = physical activity; CI = confidence interval.

The results identified no significant differences. Including additional variables in future research may help further clarify gender-based differences in depressive symptoms.

Cross-sectional studies are a suitable method for studying the association between regular exercise and depressive symptoms for determining the additional elements that relate to depressive phenomenon in older people. Although this study showed the existence of a negative relationship between regular exercise and depressive symptoms, this relationship is not necessarily causal. Therefore, randomized clinical trials are suggested for further studies in Taiwan.

This population-based study supports that regular exercise is a significant predictor of depressive symptoms in elderly men and women and that a lack of regular exercise may cause severe public health problems. Increasing healthcare expenses and illness severities may overwhelm the response capabilities of the government. Therefore, effective exercise interventions such as municipality-led walking programs (Maki et al., 2012) and laughter yoga (Shahidi et al., 2011) may become especially important in the future. Regular exercise is cheaper than treatment, and older adults may elect to exercise indoors or outdoors and to exercise independently or in groups. It is thus worthwhile to encourage elderly individuals to exercise regularly to relieve depressive symptoms and to promote good mental health.

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北台灣社區老人規律運動與憂鬱症狀之研究

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背景

根據世界衛生組織的估計到了2020年，憂鬱疾病會變成全球疾病負擔的第二位。由於台灣老人人口愈來愈多，導致台灣高齡化社會的來臨，所以台灣老人的心理健康更值得關注。

目的

本研究主要的目的，在於探討北台灣不同性別的社區老人，規律運動與憂鬱症狀之關聯。

方法

本研究利用以抽取率與單位大小成比例方式(Probability Proportional to Size, PPS)，抽取北台灣65歲以上的老人。利用橫斷性研究及面訪收集老人運動行為、憂鬱症狀及憂鬱相關因素。使用百分比、卡方、*t*檢定及邏輯斯迴歸等方式進行統計分析。

結果

共1,020位老人完成問卷調查。研究對象平均為73.5歲，男性占44.5%、女性占55.5%；有憂鬱症狀之個案共217位(21.3%)、有規律運動之個案共585位(57.4%)。邏輯斯迴歸結果顯示：規律運動是老人憂鬱症狀的重要預測因子(勝算比3.54，95%信賴區間為1.76-7.12)，其餘如性別、慢性疾病、健康狀態等均與憂鬱症狀無顯著關聯。此外，不論男性或女性老人，規律運動是憂鬱症狀的重要預測因子(男性勝算比4.76，95%信賴區間為1.65-13.72；女性勝算比3.03，95%信賴區間為1.18-7.69)，其餘因素與憂鬱症狀皆無顯著關聯。

結論/ 實務應用

由上述研究結果顯示，不論男女老人，規律運動都是憂鬱症狀的重要預測因子。應多鼓勵老人持續性地運動，以促進心理健康。

關鍵詞：老人、憂鬱症狀、規律運動、性別、台灣。

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