*Article*

# Health Capability and Psychological Effects of Regular Exercise on Adults: Middle-Aged and Older

The International Journal of Aging and Human Development
0(0) 1–18

DOI: 10.1177/0091415019882009
journals.sagepub.com/home/ahd
SAGE

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## Abstract

This study sought to determine whether there is any difference on participation in regular exercise between middle-aged and older adults and to determine whether the benefits of regular exercise differed between middle-aged and older adults in terms of health capability, mood, or anxiety symptoms and life-satisfaction level. The results indicated that older adults engaged in regular exercise more frequently than middle-aged adults. In addition, exercise participants among middle-aged adults had the better health capabilities, lower depression and anxiety symptoms, and higher life-satisfaction level than nonparticipants. On the other hands, older adults tended to be negatively associated with depression and anxiety symptoms and be positively correlated with life-satisfaction level than middle-aged adults even if middle-aged adults had the better health capabilities. These findings might be beneficial to provide appropriate exercise programs, to prevent and minimize the negative symptoms of anxiety and depression, and to facilitate the life-satisfaction level.

## Keywords

aging, anxiety, depression, exercise, health, life satisfaction

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## Introduction

The number of older adults has been rapidly increasing, as has the world population, generally. According the Population Reference Bureau (2018), 9% of worldwide population were aged 65 years or older in 2018, and the number will likely increase to 16% by 2050. Thirteen countries have at least 20% of their population aged 65 years or older, a number that will increase to 82 countries in 2050. Similarly, the U.S. population of those aged 65 years or older has increased from 37.2 million in 2006 to 49.2 million in 2016 (a 33% increase). This number is projected to reach 98 million (a 49% increase) in 2060 (Administration for Community Living, 2018). On the other hand, middle-aged adults (between the ages of 45 and 64 years) made up the fastest growing group (a 31.5% increase) from 2000 to 2010 due to the aging of the Baby Boomer generation in the United States (Howden & Meyer, 2010). Another study from the Administration for Community Living (2018) indicated that the U.S. population aged 45 to 64 years increased 12% from 2006 and 2016. This number is projected to increase from 84.3 million in 2016 to 97.0 million in 2060 (U.S. Census Bureau, 2017).

Aging is the natural biological and cognitive process that is common to all members of any given species (McGuire, Boyd, & Tedrick, 2009). Previous research has shown that the function of major biological systems declines from 10% to 30% of peak values in the middle age, which typically extends from ages 45 to 65 years (Howden & Meyer, 2010; Leitner & Leitner, 2012; Shephard, 1997). Older age, which is refers to those aged 65 years or older, involves further loss of function in such systems as the musculoskeletal (decline of skeletal muscle mass, etc.), cardiovascular (decrease in maximum heart rate, etc.), lymphatic and immune (increase in susceptibility to infections, etc.), respiratory (reduced amount of oxygen taken up by the blood, etc.), and sensory (vision, hearing, etc.; American College of Sports Medicine, 2013; Chodzko-Zajko et al., 2009; Erber, 2005; Ferrini & Ferrini, 2008; Leitner & Leitner, 2012). These changes affect each person's physical and mental health, psychological well-being, longevity, and life expectancy. Rogers and Evans (1993) discovered that most individuals maintained muscular strength up to about age 45 years, but then saw it deteriorate by 5% to 10% every 10 years. Another possible constraint on regular exercise can be the change of life pattern that older adults experience. Watching TV has been the most common leisure activity among older adults aged 65 years or older. In 2014, they spent an average of 4.25 hours daily watching TV compared with 0.25 hours spent participating in sports, exercise, and recreation activities (Bureau of Labor Statistics, 2015). Spending substantial time on passive activities can be a cause of adverse health outcomes (Cherkas et al., 2008; Williams, Raynor, & Ciccolo, 2008). Recently, Cho, Post, and Kim (2018) studied how passive and active leisure activities influence older adults' life-satisfaction levels. The results indicated that older adults spent significantly more time on passive leisure activities,

such as watching TV or listening to the radio, than in active physical pursuits or exercise. Furthermore, aging individuals might be less able to engage in engagement exercise because of various physical limitations.

As the explosion of population, the importance of healthy life has been considered regardless of all ages. A substantial body of research has indicated that engaging in regular exercise is one of the best ways to promote physiological health and cognitive functioning. (American College of Sports Medicine, 2013; Brown, Davison, McClean, & Murphy, 2015; Chodzko-Zajko et al., 2009; Ferrini & Ferrini, 2008; Leitner & Leitner, 2012; Peterson, Rhea, Sen, & Gordon, 2010; Thobaben, 2009; Weinstein, Maayan, & Weinstein, 2015). Regular exercise can be defined as exercise people participate in for up 20 to 30 minutes 3 or 4 times a week (American College of Sports Medicine, 2013). In addition to its contributions toward physiological health, regular exercise has been shown to offer psychological benefits to people of all ages, regardless of their health condition and capability (Knapen, Vancampfort, Moriën, & Marchal, 2015; Martinez, Kilpatrick, Salomon, Jung, & Little, 2015; Morris et al., 2018; Stonerock, Hoffman, Smith, & Blumenthal, 2015). Considering psychological benefits of engagement on regular exercise for adults and older adults, research has shown clearly that regular exercise increases psychological well-being, quality of life, and life-satisfaction levels while decreasing; relieving; or preventing anxiety, depression, and anger (Anderson & Shivakumar, 2013; Carek, Laibstain, & Carek, 2011; Chodzko-Zajko et al., 2009; Jazaieri, Goldin, Werner, Ziv, & Gross, 2012; Weinstein et al., 2015).

Anxiety and depression symptoms are considered to be the most common psychiatric conditions afflicting individuals (Carek et al., 2011). According to the World Health Organization (2017), the estimated number of individuals living with anxiety disorder was 3.6% of the world population in 2015 (260 million people), an increase of approximately 15% over 2005. Furthermore, more than 322 million individuals worldwide were living with depression in 2015, with prevalence rates peaking in older adulthood. This number increased by 18% between 2005 and 2015. Many studies have indicated that engaging in regular exercise was positively associated to decrease anxiety and depression levels among adults and older adults (Jazaieri et al., 2012; Johansson, Hassmén, & Jouper, 2008; Knapen et al., 2015; Tapps, Passmore, Lindenmeier, & Bishop, 2013; Weinstein et al., 2015). A meta-analytic review of the effect of exercise on mood in older adults in 32 studies showed that regular exercise was associated with improved mood in older adults (Arent, Landers, & Etnier, 2000). Morris et al. (2018) reviewed seven computerized databases using such search terms as exercise, depression, and anxiety, and the results showed that exercise lowered depression and anxiety scores among adults more effectively than cognitive behavioral therapy. Another study measured older adults' depression levels for 12 weeks, while they engaged in regular resistance band exercises. The participants significantly decreased their depression levels compared with a nonexercise older adults' group (Tapps et al., 2013). A study of regular Qigong exercise on mood

and anxiety among middle-aged and older adults found that exercise participation was associated with significant decrease of depression, anger, fatigue, and anxiety scores (Johansson et al., 2008).

Life satisfaction refers to individuals' assessment of their psychological and subjective well-being, affection, happiness, and quality of life (Edginton, DeGraaf, Dieser, & Edginton, 2005). It has been well documented that life-satisfaction level decreases with aging because of the physical and social losses (Edginton et al., 2005; Ferrini & Ferrini, 2008). There is also considerable evidence the literature that exercise participation is associated with improvements in psychological well-being, quality of life, and life-satisfaction level among adults and older adults (Chodzko-Zajko et al., 2009; Jazaieri et al., 2012; Netz, Wu, Becker, & Tenenbaum, 2005). Arent et al. (2000) found that exercise participation by older adults improved body composition, fitness, longevity, and personal care activities that led to a dramatically improved quality of life. Another studied provided three different types of exercise intervention to older adults for 13 weeks: traditional strength training, functional strength training, and endurance training. All three types of training were positively associated with improvement in older adults' life-satisfaction levels (Solberg et al., 2013).

Given the numerous benefits of regular exercise, a large number of studies have investigated its relationship to health capability and psychological factors, including mood and anxiety symptoms and life satisfaction at all age levels. However, there has been little research into the differences that regular exercise has on various age groups. In addition, no studies have examined the differences in mood and anxiety symptoms and life-satisfaction level between middle-aged adults and their older counterparts. Thus, the primary aims of this study were to determine whether the benefits of regular exercise differed between middle-aged and older adults in terms of health capabilities, mood or anxiety symptoms, and life-satisfaction level. Therefore, the hypotheses aimed through this study were following:

- **Hypothesis 1:** There will be significant differences on participation in regular exercise between middle-aged and older adults on their health capabilities.
- **Hypothesis 2:** There will be significant differences on participation in regular exercise between middle-aged and older adults on their mood or anxiety symptoms.
- **Hypothesis 3:** There will be significant differences on participation in regular exercise between middle-aged and older adults on their life-satisfaction level.

## Methods

### *Study Design*

The subjects came from the survey of Midlife in the United Sates (MIDUS Refresher) Biomarker Project that was originally conducted as the Successful

Midlife Development program in 1995 to 1996 (MIDUS 1). Those subjects were each asked to participate in a phone interview and a subsequent mail-in survey (MIDUS 2) after approximately 9 years of investigation by MIDUS 1. The Biomarker Project was part of MIDUS 2, wherein subjects who had completed the phone interview were asked to participate in a clinical assessment (Donoho, Crimmins, & Seeman, 2013). Three clinical research centers located in the University of Wisconsin-Madison, the University of California, Los Angeles, and Georgetown University took part in the Biomarker Project, which included both psychosocial and biomarker assessments. More specifically, the Mood and Anxiety Symptom Questionnaire (MASQ) and the Satisfaction With Life Scale (SWLS) were used for psychosocial assessments of the effects of regular exercise on health and biomarker assessments.

## Participants

A total of 576 adults (387 middle-aged adults and 189 older adults) completed the health capability assessments and self-administered questionnaire, although 26 surveys had to be removed due to the incompletion of either assessments or questionnaire. The analytic sample was narrowed to include only individuals between the ages of 45 and 76 years, so a total of 550 participants were evaluated for this research (371 middle-aged adults and 179 older adults). This study followed Howden and Meyer's (2010) U.S. Census age range classification that defined middle-aged adults as between the ages 45 and 64 years, while the older adults' group was categorized as those aged 65 years and older.

## Measurement

*Regular exercise and health capability assessments.* Participants were asked, "Do you engage in regular exercise, or activity, of any type for 20 minutes or more at least 3 times/week?" Afterward, body mass index (BMI) and vital signs were measured and functional assessments (grip strength, peak flow, 50-foot timed walk, and chair stands) were examined during an overnight stay at the clinical research centers. Grip strength assessment asked each subject to grip and squeeze a measurement device as hard as they could until measurement did not get higher. Peak flow was the assessment indicator of airway function that measured the maximum volume of subjects' exhalations. A 50-feet timed walk examination assessed the normal gait speed at which each subject walked. Finally, the chair stand assessment recorded the time it took subjects to rise from a chair and sit down again 5 times while keeping arms folded across the chest.

*Mood and Anxiety Symptom Questionnaire.* Clark and Watson (1991) proposed a paradigm in which symptoms of anxiety and depression were categorized into three groups. The MASQ was developed by testing the tripartite model, which revealed three factors: General Distress, Anhedonic Depression, and Anxiety

Arousal. The MASQ was originally composed of 90 items that comprised six factors measured by a 5-point Likert-type scale, with responses ranging from *not at all* (1) to *extremely* (5). Higher scores indicate greater levels of symptomatology. This study excluded *Mixed Symptoms of General Distress* scales due to the purpose of the research.

General Distress scales consisted of subfactors, the Depressive Symptoms (DS) scale and Anxious Symptoms (AS) scale. The DS scale measures mood relative to depression (12 items; e.g., "Felt sad"), while the AS scale measures relative anxiety (11 items; e.g., "Felt afraid"). The Anhedonic Depression scales consisted of the Loss of Interest (LI) scales (8 items; e.g., "Felt nothing was enjoyable") and reverse-keyed items of high positive affect (HPA; 14 items; e.g., "Felt really happy"). Finally, the Anxious Arousal (AA) scale measures somatic and arousal symptoms (17 items; e.g., "Felt dizzy or lightheaded"; Babson, Trainor, Feldner, & Blumenthal, 2010; Keogh & Reidy, 2000; Watson, Clark, et al., 1995; Watson, Weber, et al., 1995). The MASQ has shown great convergent and discriminant validity (Watson, Clark, et al., 1995) and good reliability in this study ($\alpha = .81$). Internal consistency of each subscale (DS: $\alpha = .89$, AS: $\alpha = .79$, LI: $\alpha = .81$, HPA: $\alpha = .94$, and AA: $\alpha = .74$) was good.

*Satisfaction With Life Scale.* The SWLS was developed by Diener et al. (1985) to make a global cognitive judgment of a person's life satisfaction. The SWLS is a 5-item scale design in which each statement is completed by choosing responses on a 5-point Likert-type scale, from *strongly disagree* (1) to *strongly agree* (7). SWLS items include "In most ways my life is close to my ideal," "The conditions of my life are excellent," "I am satisfied with life," "So far I have gotten the important things I want in life," and "If I could live my life over, I would change almost nothing." Items were summed, yielding a range from 5 to 35 that higher scores reflected grater levels of life satisfaction. Internal consistency in this study was high enough to analyze it ($\alpha = .88$).

## Data Analysis

Data were analyzed by the Statistical Package for the Social Sciences 20 (SPSS20) program to measure the descriptive means and proportions, data reliability, and the mean differences between middle-aged and older adults for the main variables: regular exercise, health assessments, mood and anxiety symptoms, and life-satisfaction level. The two-way analysis of variance (ANOVA) and multivariate ANOVA (MANOVA) test were utilized to determine whether the regular exercise differences between middle-aged and older adults influenced health assessments, mood and anxiety symptoms, and life-satisfaction level, with alpha set at 0.05. Prior to analyzing the data, the homogeneity of variances and normality tests were performed. The results confirmed that the data were appropriated to be examined.

## Results

The demographic characteristics of sex were composed of half-and-half participants, but the number of females (54.7%) was higher in middle-aged group, while older adults' group had fewer female participants (39.7%). Approximately 60 percentiles of the participants included in the research sample were married, followed by divorced (18.6%) and never married (11.1%) participants. In addition, engagement on regular exercise for 20 minutes or more at least 3 times a week was reported by 70.6% of middle-aged adults and 79.3% of older adults. This result showed that the older adults engaged in regular exercise more frequently than middle-aged adults (Table 1).

The results of engaging in regular exercise between middle-aged and older adults' effects on health capability assessments showed that middle-aged adults had higher mean scores on BMI, pulse, grip strength and peak flow, while older adults had higher mean scores on the 50-feet timed walk and chair stands (Table 2). Furthermore, the overall results of health capacities indicated that middle-aged adults had better abilities or capacities of all health variables statistically. The two-way ANOVA test was utilized to analyze the differences for health capacities by engaging in regular exercise and age groups between middle-aged and older adults. As shown in Table 2, the chair stand health assessment indicated a statistically significant interaction effect of regular exercise between middle-aged and older adults, $F(1) = 6.278$, $p = .013$. In addition, as shown in Figure 1, those engaging in regular exercise in the older adults' group

**Table 1.** Results of Descriptive Demographic Characteristics.

| | Middle-aged adults | Older adults | Total |
|---|---|---|---|
| Sex | | | |
| Female | 203 (54.7%) | 71 (39.7%) | 274 (49.8%) |
| Male | 168 (45.3%) | 108 (60.3%) | 276 (50.2%) |
| Marital status | | | |
| Married | 216 (58.2%) | 115 (64.2%) | 331(60.2%) |
| Separated | 13 (3.5%) | 1 (0.1%) | 14 (2.5%) |
| Divorced | 73 (19.7%) | 29 (16.2%) | 102 (18.6%) |
| Widowed | 13 (3.5%) | 22 (12.3%) | 35 (6.4%) |
| Never married | 51 (13.7%) | 10 (5.6%) | 61 (11.1%) |
| Living with someone in committed relationship | 5 (1.3%) | 2 (0.1%) | 7 (1.3%) |
| Engagement on regular exercise | | | |
| Yes | 262 (70.6%) | 142 (79.3%) | 404 (73.5%) |
| No | 109 (29.4%) | 37 (20.7%) | 146 (26.5%) |
| Total | 371 (67.5%) | 179 (32.5%) | 550 (100%) |
| Age ($M \pm SD$) | $52.4 \pm 6.07$ | $68.2 \pm 3.86$ | $57.6 \pm 9.20$ |

*Note.* $M$ = mean; $SD$ = standard deviation.

**Table 2.** Results of Descriptive Statistic and Two-Way Analysis of Variance Test for Health Capability Assessments by Engagement on Regular Exercise Between Middle-Aged and Older Adults.

| Health capacity | Middle-aged adults ($n = 371$) | Older adults ($n = 179$) | Total ($n = 550$) | Main effect of exercise | Main effect of age | Interaction effect of exercise and age |
|---|---|---|---|---|---|---|
| BMI | | | | | | |
| Exercise ($n = 404$) | 29.16 ± 6.52 | 29.13 ± 5.48 | 29.15 ± 6.17 | $F(1) = 16.796$ | $F(1) = 0.081$ | $F(1) = 0.103$ |
| Nonexercise ($n = 146$) | 31.81 ± 7.78 | 32.24 ± 5.42 | 31.92 ± 7.24 | $p < .001$ | $p = .776$ | $p = .749$ |
| Total ($n = 550$) | 29.94 ± 7.01 | 29.77 ± 5.59 | | | | |
| Pulse | | | | | | |
| Exercise ($n = 404$) | 69.61 ± 11.01 | 69.02 ± 11.82 | 69.41 ± 11.29 | $F(1) = 7.661$ | $F(1) = 0.871$ | $F(1) = 0.207$ |
| Nonexercise ($n = 146$) | 73.61 ± 11.79 | 71.89 ± 11.91 | 73.18 ± 11.80 | $p = .006$ | $p = .351$ | $p = .649$ |
| Total ($n = 550$) | 70.79 ± 11.38 | 69.61 ± 11.87 | | | | |
| Grip strength (right) | | | | | | |
| Exercise ($n = 404$) | 34.86 ± 11.46 | 33.49 ± 11.17 | 34.37 ± 11.37 | $F(1) = 1.783$ | $F(1) = 5.197$ | $F(1) = 1.410$ |
| Nonexercise ($n = 146$) | 34.67 ± 12.94 | 30.32 ± 8.99 | 33.57 ± 12.18 | $p = .182$ | $p = .023$ | $p = .236$ |
| Total ($n = 550$) | 34.80 ± 11.90 | 32.83 ± 10.81 | | | | |
| Grip strength (left) | | | | | | |
| Exercise ($n = 404$) | 33.84 ± 11.71 | 31.65 ± 10.75 | 33.07 ± 11.42 | $F(1) = 3.406$ | $F(1) = 4.668$ | $F(1) = 0.161$ |
| Nonexercise ($n = 146$) | 32.05 ± 12.55 | 28.86 ± 8.23 | 31.24 ± 11.66 | $p = .065$ | $p = .031$ | $p = .688$ |
| Total ($n = 550$) | 33.31 ± 11.98 | 31.08 ± 10.33 | | | | |
| Peak flow | | | | | | |
| Exercise ($n = 404$) | 459.12 ± 130.90 | 451.07 ± 121.31 | 456.29 ± 127.52 | $F(1) = 2.618$ | $F(1) = 2.158$ | $F(1) = 0.807$ |
| Nonexercise ($n = 146$) | 448.96 ± 143.06 | 415.54 ± 116.86 | 440.49 ± 137.29 | $p = .106$ | $p = .142$ | $p = .369$ |
| Total ($n = 550$) | 456.14 ± 134.47 | 443.73 ± 134.47 | | | | |
| 50-foot timed walk | | | | | | |
| Exercise ($n = 404$) | 12.81 ± 2.12 | 13.72 ± 2.93 | 13.13 ± 2.47 | $F(1) = 11.831$ | $F(1) = 4.057$ | $F(1) = 1.312$ |
| Nonexercise ($n = 146$) | 14.13 ± 3.44 | 14.39 ± 2.20 | 14.19 ± 3.17 | $p = .001$ | $p = .044$ | $p = .252$ |
| Total ($n = 550$) | 13.20 ± 2.65 | 13.85 ± 2.80 | | | | |
| Chair stand | | | | | | |
| Exercise ($n = 404$) | 8.73 ± 3.72 | 10.53 ± 4.32 | 9.36 ± 4.03 | $F(1) = 2.697$ | $F(1) = 1.441$ | $F(1) = 6.278$ |
| Nonexercise ($n = 146$) | 10.74 ± 6.45 | 10.11 ± 2.55 | 10.58 ± 5.72 | $p = .101$ | $p = .231$ | $p = .013$ |
| Total ($n = 550$) | 9.32 ± 4.77 | 10.44 ± 4.02 | | | | |

*Note.* BMI = body mass index.

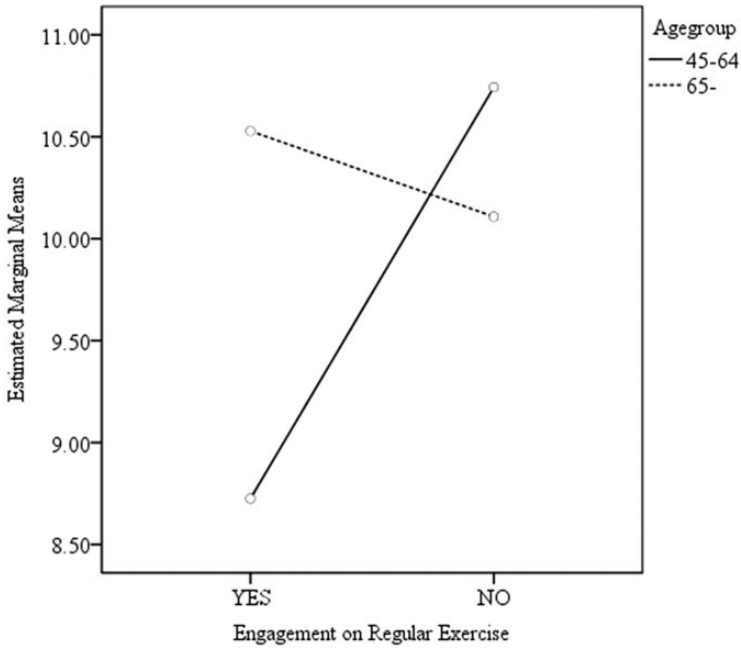


**Figure 1.** Interaction effect of engagement on regular exercise and age-group on chair stands assessment.

had higher mean scores on the chair stand assessment, while middle-aged participants in the nonexercise group had higher mean scores.

Other than the chair stand assessment, there were no significant differences in the interaction effect of regular exercise between middle-aged and older adults on health capability assessments: BMI, pulse, grip strength (right), grip strength (left), peak flow, and the 50-feet timed walk. Therefore, the main effect of engagement on regular exercise indicated that the exercise group ($M$: 29.15) had significantly lower means on BMI, $F(1) = 16.796$, $p < .001$, than the nonexercise group ($M$: 31.92), while the exercise group ($M$: 69.41) also had statistically lower means on pulse, $F(1) = 7.661$, $p = .006$, than the nonexercise group ($M$: 73.18). The analysis also determined that exercise participants ($M$: 13.13) were statistically faster on 50-foot timed walk, $F(1) = 11.831$, $p = .001$, than nonexercise participants ($M$: 14.19).

In addition, the results of the main effect of age-group revealed that middle-aged adults, right ($M$: 34.80) and left ($M$: 33.31), showed higher means of grip strength of both the right hand, $F(1) = 5.197$, $p = .023$, and left hand, $F(1) = 4.668$, $p = .031$, than older adults, right ($M$: 32.83) and left ($M$: 31.08). The analysis also indicated that middle-aged adults ($M$: 13.20) had statistically

lower means scores on the 50-foot timed walk, $F(1) = 4.057$, $p = .044$, than older adults ($M$: 13.85; Table 2).

The results of MASQ showed middle-aged adults were higher mean scores of all factors (DS, AS, LI, HPA, and AA). The results were examined that middle-aged adults were more likely to have higher DS, AS, LI, and AA. Higher mean scores of HPA variable were lower HPA of middle-aged adults because the data were recoding as reverse-keyed items. Overall, older adults tended to have the lower symptoms of the tripartite model of anxiety and depression than middle-aged adults. The MANOVA test indicated that the main effect of engagement on regular exercise, $F(5, 542) = 3.392$, $p = .005$; Wilks' lambda ($\Lambda$) = .970, and age-group, $F(5, 542) = 2.381$, $p = .037$; Wilks' lambda ($\Lambda$) = .979, were statically associated to MASQ. However, there was no statistical significance of the interaction effect of engagement on regular exercise and age-group on MASQ. More specifically, the MANOVA test determined that the interaction effect of engagement on regular exercise between middle-aged and older adults did not influence on all factors of MASQ statistically. Therefore, the main effect of engagement on regular exercise on each factor of MASQ were analyzed that nonexercise group, AS ($M$: 1.54), LI ($M$: 1.60), HPA ($M$: 3.00), and AA ($M$: 1.32), had significantly higher means on AS, $F(1) = 6.280$, $p = .012$, LI, $F(1) = 10.087$, $p = .002$, HPA, $F(1) = 9.561$, $p = .002$, and AA, $F(1) = 4.552$, $p = .033$, than exercise group, AS ($M$: 1.44), LI ($M$: 1.44), HPA ($M$: 2.72), and AA ($M$: 1.25).

In addition, the main effect of age-group was statistically difference on DS, $F(1) = 4.190$, $p = .041$, AS, $F(1) = 4.522$, $p = .034$, and HPA, $F(1) = 9.450$, $p = .002$, that older adults, DS ($M$: 1.42), AS ($M$: 1.37), and HPA ($M$: 2.63), had statistically lower mean scores than middle-aged adults, DS ($M$: 1.56), AS ($M$: 1.51), and HPA ($M$: 2.87; Table 3).

Finally, the results of SWLS provided that middle-aged adults and nonexercise group were lower mean scores of life-satisfaction levels. More specifically, the interaction effect of engagement on regular exercise and age-group was not statistically significance on life-satisfaction level. However, both main effect of engagement on regular exercise, $F(1) = 6.307$, $p = .012$, and age-group, $F(1) = 14.934$, $p = .000$, were determined the significance that exercise group ($M$: 24.50) and older adults ($M$: 25.19) were statistically higher mean scores of SWLS than nonexercise group ($M$: 21.30) and middle-aged adults ($M$: 23.09) by analyzing the two-way ANOVA (Table 4).

## Discussion

This study has attempted to determine the difference in regular exercise between middle-aged and older adults. The results indicate that older adults participated in regular exercise more frequently than middle-aged adults. Older adults might have more free time to pursue leisure activities than middle-aged adults.

**Table 3.** Results of Descriptive Statistics and Multivariate Analysis of Variance Test for MASQ by Engagement on Regular Exercise Between Middle-Aged and Older Adults.

| MASQ | Middle-aged adults ($n = 371$) | Older adults ($n = 179$) | Total ($n = 550$) | Main effect of exercise | Main effect of age | Interaction effect of exercise and age |
|---|---|---|---|---|---|---|
| Depressive symptoms | | | | | | |
| Exercise ($n = 404$) | $1.53 \pm 0.58$ | $1.40 \pm 0.34$ | $1.49 \pm 0.52$ | $F(1) = 3.645$ | $F(1) = 4.190$ | $F(1) = 0.220$ |
| Nonexercise ($n = 146$) | $1.61 \pm 0.47$ | $1.53 \pm 0.58$ | $1.59 \pm 0.51$ | $p = .057$ | $p = .041$ | $p = .639$ |
| Total ($n = 550$) | $1.56 \pm 0.56$ | $1.42 \pm 0.41$ | | | | |
| Anxious symptoms | | | | | | |
| Exercise ($n = 404$) | $1.50 \pm 0.44$ | $1.33 \pm 0.31$ | $1.44 \pm 0.41$ | $F(1) = 6.280$ | $F(1) = 4.522$ | $F(1) = 2.268$ |
| Nonexercise ($n = 146$) | $1.54 \pm 0.40$ | $1.52 \pm 0.57$ | $1.54 \pm 0.45$ | $p = .012$ | $p = .034$ | $p = .133$ |
| Total ($n = 550$) | $1.51 \pm 0.43$ | $1.37 \pm 0.39$ | | | | |
| Loss of interest | | | | | | |
| Exercise ($n = 404$) | $1.48 \pm 0.52$ | $1.36 \pm 0.39$ | $1.44 \pm 0.48$ | $F(1) = 10.087$ | $F(1) = 2.387$ | $F(1) = 0.654$ |
| Nonexercise ($n = 146$) | $1.61 \pm 0.52$ | $1.57 \pm 0.50$ | $1.60 \pm 0.51$ | $p = .002$ | $p = .123$ | $p = .419$ |
| Total ($n = 550$) | $1.52 \pm 0.53$ | $1.40 \pm 0.42$ | | | | |
| High positive affect | | | | | | |
| Exercise ($n = 404$) | $2.80 \pm 0.73$ | $2.58 \pm 0.69$ | $2.72 \pm 0.72$ | $F(1) = 9.561$ | $F(1) = 9.450$ | $F(1) = 0.202$ |
| Nonexercise ($n = 146$) | $3.07 \pm 0.75$ | $2.79 \pm 0.78$ | $3.00 \pm 0.76$ | $p = .002$ | $p = .002$ | $p = .653$ |
| Total ($n = 550$) | $2.87 \pm 0.75$ | $2.63 \pm 0.71$ | | | | |
| Anxious arousal | | | | | | |
| Exercise ($n = 404$) | $1.27 \pm 0.32$ | $1.22 \pm 0.22$ | $1.25 \pm 0.29$ | $F(1) = 4.552$ | $F(1) = 0.646$ | $F(1) = 0.594$ |
| Nonexercise ($n = 146$) | $1.32 \pm 0.29$ | $1.32 \pm 0.28$ | $1.32 \pm 0.28$ | $p = .033$ | $p = .422$ | $p = .441$ |
| Total ($n = 550$) | $1.29 \pm 0.31$ | $1.24 \pm 0.24$ | | | | |
| Main effect of exercise on MASQ | $F$ (5, 542) = 3.392, $p = .005$; Wilks' $\Lambda = .970$ | | | | | |
| Main effect of age on MASQ | $F$ (5, 542) = 2.381, $p = .037$; Wilks' $\Lambda = .979$ | | | | | |
| Interaction effect of exercise and age on MASQ | $F$ (5, 542) = 0.728, $p = .603$; Wilks' $\Lambda = .993$. | | | | | |

*Note.* MASQ = Mood and Anxiety Symptom Questionnaire.

**Table 4.** Results of Descriptive Statistic and Two-Way Analysis of Variance Test for SWLS by Engagement on Regular Exercise Between Middle-Aged and Older Adults.

| SWLS | Middle-aged adults ($n = 371$) | Older adults ($n = 179$) | Total ($n = 550$) | Main effect of exercise | Main effect of age | Interaction effect of exercise and age |
|---|---|---|---|---|---|---|
| Life-satisfaction level | | | | | | |
| Exercise ($n = 404$) | $23.83 \pm 6.49$ | $25.73 \pm 5.30$ | $24.50 \pm 6.16$ | $F(1) = 6.307$ | $F(1) = 14.934$ | $F(1) = 0.050$ |
| Nonexercise ($n = 146$) | $21.30 \pm 7.37$ | $22.90 \pm 6.64$ | $21.71 \pm 7.20$ | $p = .012$ | $p < .001$ | $p = .823$ |
| Total ($n = 550$) | $23.09 \pm 6.85$ | $25.15 \pm 5.70$ | | | | |

*Note.* SWLS = Satisfaction With Life Scale.

The recent survey by the Bureau of Labor Statistics (2018) supports the findings that middle-aged adults' primary duty would be work, where they spent an average of 4.5 hours a day, while many older adults are either retired from their primary job or have only a part-time job (1.4 hours). However, the current results suggest that both groups might consider exercise as an important activity because approximately 75% of respondents engaged on some type of regular exercise. Therefore, this finding might be supporting evidence that it has been the mainstream for adults to regard exercise as the fundamental in modern society.

## *Health Capability*

The results of health capability assessments between middle-aged and older adults indicated that middle-aged adults tend to have the better quality of health. Numerous studies have demonstrated that decline of the biological system is common to all individuals with the normal aging process (American College of Sports Medicine, 2013). The current results also indicate that exercise participants had superior health capacities in terms of BMI, pulse rate, and 50-feet timed walk rate, but no differences on grip strength, peak flow, and chair stand rate. It might be possible to suggest that regular exercise can be connected more with the individual's aerobic abilities than physical strength. Middle-aged and older adults might tend to spend more time on regular exercise by participating in aerobic exercise activities like walking, jogging, cycling, and swimming than young adults. Furthermore, the decline of physical capabilities such as loss of muscle can be avoided in middle-aged and older adults from strengthening or resistance exercises. Another possibility might be the greater convenience and accessibility of provide aerobic exercise, which does not require utilizing free weights and exercise machines. It is an interesting finding in this study that the chair stand assessment showed the significance of the interaction effect of exercise between middle-aged and older adults. The results suggest that exercise participants among middle-aged adults had the better capabilities, but

nonparticipants of regular exercise among older adults had slightly faster records on the chair stand. However, there was only about 0.4 seconds difference between exercise participants and nonparticipants among older adults.

### Anxiety and Depression Symptoms

Even if there were no significance to the interaction effect of exercise participation between middle-aged and older adults on anxiety and depression symptoms, this study found that regular exercise was negatively associated with anxiety and depression symptoms, and thus that might be one of the ways to reduce the symptoms of anxiety and depression. In the MASQ, exercise participation was negatively associated with AS, LI, and AA. This finding is supported by numerous previous studies (Jazaieri et al., 2012; Johansson et al., 2008; Knapen et al., 2015; Tapps et al., 2013; Weinstein et al., 2015). This study's finding that engagement on regular exercise has positive effects on anxiety and depression symptoms provides the verification of previous research. In addition, our findings suggest that middle-aged adults manifest higher levels of anxiety and depression symptoms than older adults. More specifically, this finding suggests that middle-aged adults had higher scores on DS and AS and lower scores on HPA in the MASQ. These finding support the conclusions of the Office for National Statistics (2016) that average anxiety level increases gradually, peaks between the ages of 45 and 59 years, but then decreases and remains relatively unchanged for those aged 65 years and older. Other previous studies support our findings that the global prevalence of anxiety and depressive disorders, as noted by the World Health Organization (2017), reported both anxiety and depressive disorders are highest rate in the middle-aged adults. Flint et al. (2010) was less prevalent in older adults than middle-aged adults, even after controlling for relevant demographic and clinical variables. Middle-aged adults might face the pressure from taking care of their children and aging parents at the same time, have more demands on balancing their work and family commitments, and struggle to gain personal free time, which can cause anxiety and depression symptoms.

### Life-Satisfaction Level

These findings of life-satisfaction level, based on exercise participation between middle-aged and older adults, did not show interaction effects. However, this study confirmed findings from the previous research suggesting that individuals who engaged in regular exercise had higher life-satisfaction levels than nonparticipants (Leitner & Leitner, 2012; Solberg et al., 2013; White, Wojcicki, & McAuley, 2009). The results also support the previous studies that life-satisfaction level was in inverse proportion to anxiety and depression symptoms (Office for National Statistics, 2016; World Health Organization, 2017).

Furthermore, older adults had higher life-satisfaction levels than middle-aged adults, which is supported by the Office for National Statistics' (2016) report that the highest average ratings of life-satisfaction level were in individuals between the ages of 65 and 79 years, while those with the lowest ratings were between the ages 45 and 59 years.

### *Limitation and Future Directions*

It is important to understand this study's limitations and to provide possible future directions. This study, conducted at the three clinical research centers, cannot be generalized to the entire population of middle-aged and older adults. Future research efforts should consider providing the assessments and surveys from different regions that might have more accurate findings. An important issue that was not addressed by this study was the role played by demographic characteristics, such as sex, race, socioeconomic status, marital status, and so on. Even if this study characterized participants as sex and marital status, these covariates were not controlled as independent variables to analyze the data. Future research could attempt to explain how demographic characteristics can affect the conclusions reached in this study. One of the primary limitations was the lack of clarification of the regular exercise that might be need to be explored in more detail. The survey question on regular exercise might be too general. Future studies should provide the specific and relevant questions to examine the description of engaging in regular exercise with more precision. Finally, life-satisfaction level was measured by the SWLS and anxiety and depression symptoms were investigated by the MASQ; these instruments might not effectively convey the diverse concepts of life-satisfaction anxiety and depression. Future study might extend this research by utilizing different survey questionnaires or instruments.

## Conclusion

The objective of this study was to gain a better understanding of differences in regular exercise between middle-aged and older adults and their effects on health capability, anxiety and depression symptoms, and life-satisfaction level. This study provides insight into the benefits of regular exercise on anxiety and depression symptoms, and life-satisfaction level for both middle-aged and older adults. Engaging in regular exercise can give participants to have the better health capabilities, reduction of anxiety and depression, and the higher life-satisfaction level needed to encourage continuation with regular exercise. Furthermore, these findings might be beneficial to provide appropriate exercise programs to the different age groups, to prevent and minimize the negative symptoms of anxiety and depression and to facilitate the life-satisfaction level. In addition, even if middle-aged adults had better health capabilities, older

adults had lower anxiety and depression symptoms and higher life-satisfaction level than middle-aged adults. Therefore, research might be needed to optimize middle-aged adults' life-satisfaction level and to minimize the anxiety and depression symptoms.

## Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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