International Journal of Gerontology 13 (2019) 134–138
https://doi.org/10.6890/IJGE.201906_13(2).0007

International Journal of Gerontology

journal homepage: http://www.sgecm.org.tw/ijge/

Original Article

# Effects of Tai Chi Exercise on the Body Composition, Self-Efficacy and Life Satisfaction of Older Adults in Korean Local Community

Chunguk Oh [a], Hyekyung Kang [b *]

[a] *Department of Nursing, Kangwon National University, Gangwon-do,* [b] *College of Nursing, Kyungbok University, Gyeonggi-do, Korea*

ARTICLE INFO

Accepted 31 July 2018

*Keywords:*
body mass index,
aged,
mental health,
self-efficacy,
Tai Ji

SUMMARY

*Background:* This study investigated the effects of tai chi on body composition, self-efficacy, and life satisfaction of older adults in a Korean community.
*Methods:* A randomized, control group pretest-posttest, experimental design was used to investigate 42 adults aged 65 years or older. Subjects were divided into an experimental group that underwent tai chi training for 6 weeks (n = 20) and a control group that did not (n = 22). Body composition, self-efficacy, and life satisfaction were measured before and after a 6-week tai chi intervention program (5 days/week).
*Results:* Compared to the control group, the experimental group showed significant reductions in body mass index (BMI) ($p < 0.004$) and body fat ($p < 0.001$) and significant increases in skeletal muscle mass ($p < 0.001$) and life satisfaction ($p < 0.001$). Self-efficacy increased in the experimental group but was not significantly different from that of the control group ($p < 0.265$).
*Conclusion:* Tai chi is an effective exercise intervention that may improve body composition and life satisfaction for older adults.



## 1. Introduction

Exercise is essential for older adults to maintain or recover their health and have an independent lifestyle. Several studies have reported that various types of exercise are highly conducive to the physical and mental health of older adults.[1–3] Exercises recommended to improve the functional physical fitness of older adults include aerobic exercises such as walking and cycling, light resistance training, and flexibility exercises to ensure adequate mobility.[4]

Tai chi, or tai chi chuan, is a globally popular and ancient Chinese martial art. Movements are performed in a low posture with knees bent, and the height of the posture and movements have different features according to the tai chi style; the diverse styles of martial arts include the Yang style, Wu style, and the recently developed Sun style.[5] Tai chi has been reported by many studies to improve muscle contraction, blood circulation, and tissue oxygenation in the cardiovascular and respiratory systems.[6–9] With regard to the musculoskeletal system, it improves flexibility, endurance, and upper and lower limb muscle strength while increasing the peak torque-to-body weight ratio of eccentric and concentric contractions of the shoulder extensor and flexor, and it significantly shortens the response time of the biceps femoris and gastrocnemius muscles.[10] Aerobic exercise increases energy release, burns body fat, and increases basal metabolism, ultimately leading to weight loss. Because of these effects, tai chi is speculated to improve factors such as body composition, cholesterol, hypertension, blood sugar, and obesity.[9,11]

Because tai chi is a low-intensity aerobic exercise that involves a small weight load, it is associated with lower risks of injury than other exercises. Therefore, it is recommended for older adults who have arthritis or are at a high risk for falling.[12] Furthermore, it does not require separate equipment, which makes it economical and eliminates any space restrictions. Tai chi also involves easy-to-follow movements, making it appropriate for older adults.[13] One recent study showed that tai chi is good for preventing or delaying lower muscle damage, which undermines the quality of life of elderly individuals.[14] Another study reported that an 8-week tai chi program for elderly women 64 years or older led to significant reductions in fatigue, pain, and depression and significant improvements in self-efficacy and quality of life.[15] Tai chi is often performed in groups, giving the lonely elderly the pleasure of being together, and as a result, the dropout rate of participants can be reduced.[13]

In South Korea, many studies have verified the effects of tai chi in women or individuals with musculoskeletal diseases; however, there are few data regarding its effects on the general elderly population. This study aimed to investigate changes in body composition, which are predictors of physical function,[16] by randomized controlled trial using 24 forms Yang's style Tai chi, as well as psychological changes in men and women aged 65 years or older. We attempted to confirm the potential of tai chi as an exercise program that effectively prevents diseases in elderly individuals with reduced physical functions.

* Corresponding author. College of Nursing, Kyungbok University, Postal No. 111138, College of Nursing Office, Pocheon Campus, 154, Sinpyeong-ro, Sinbuk-myeon, Pocheon-si, Gyeonggi-do, Korea.
*E-mail addresses:* hkkang@kbu.ac.kr (H. K. Kang)

## 2. Patients and methods

### 2.1. Study design

This study used a randomized, control group, pretest-posttest, experimental design to investigate the effects of a 6-week, 24-form tai chi program (5 days/week) on body composition, self-efficacy, and satisfaction with life for adults aged 65 years or older.

### 2.2. Participants

Subjects included 42 elderly men and women aged 65 years or older who visited a senior welfare center located in Chung-Buk province, South-Korea who met the selection criteria. The inclusion criteria were age 65 years or older, no health problems that prohibited exercise. Exclusion criteria were hearing dysfunction that hindered following along with the exercise program, diagnosis of and treatment for lower back pain and osteoarthritis, at risk for falling due to Parkinson and missed more than two sessions of the intervention program. According to a prior study,[9] the required sample size for the t-test was calculated with G*power to be 18 for each group to achieve a significance of 0.05, power of 0.80, and an effect size of 0.5. The withdrawal rate was 20%. Participants were assigned to each group 22 persons each based on simple randomization using a coin toss. To modify the restrictions of coin toss, prohibited coin toss repeatedly. Nurse of welfare center generated the random allocation sequence, social worker enrolled participants under blinded condition. Finally chief manager of welfare center assigned participants to interventions. Pretest and posttest measurements were obtained from each patient of the experimental and control groups in the morning (at 10 am) at multipurpose room of welfare center blinded participants after assignment. Trained assistant joined the data collecting procedure. Two participants withdrew from the study for personal reasons, resulting in 20 participants in the experimental group and 22 participants in the control group, for a total of 42 participants (Fig. 1). This study was approved by the Institutional Review Board at the Nambu University (no. 1041478-2017-HR-013). Data were collected from October 2017 to November 2017 after individual participated in a 6-week tai chi intervention program. Exercise was performed in the multipurpose room of a senior welfare center from 14:00~15:00 (60 minutes per session). Equal intervention was done for participants want to participate in control group after the research.

### 2.3. Intervention program

The intervention used in this study was a 6-week 24-form Yang-style tai chi program (60 minutes per session, 5 days/week). Patients learned the postures of the main exercise under the investigator's instruction during weeks 1–6 and repeated the main exercise of the previous week during every week of training. Exercise was performed at a senior welfare center. Per the recommendations by the American College of Sports Medicine,[17] exercise intensity was maintained at a rate of perceived exertion of 11–13 on the Borg scale. The program comprised a 10-minute warm-up, 45 minutes of exercise, and a 5-minute cool-down. The principle investigator of this study instructed the tai chi program, and content validity of the exercise program was verified by one orthopedic surgeon and one exercise specialist.

#### 2.3.1. Warm-up

Patients performed a 10-min warm-up, stretching the neck, hands, arms, chest, flanks, legs, and calf; raising and turning the shoulders; and pulling the legs. Each posture was maintained for 20–30 s and repeated twice; intensity was maintained at RPE 8–9.

#### 2.3.2. Main exercise

Patients practiced the 24-posture simplified form of Tai Chi below with 45 min at RPE 11–13.

(1) Commencing Form, (2) The Wild Horse's Mane on Both Sides, (3) The White Crane, (4) Spreads its Wings, (5) Brush Knee and Step Forward, (6) Playing the Lute, (7) Reverse Reeling Forearm, (8) Left Grasp the Sparrow's Tail, (9) Right Grasp the Sparrow's Tail, (10) Single Whip, (11) Wave Hands Like Clouds, (12) Single Whip, (13) High Pat on Horse, (14) Right Heel Kick, (15) Strike to Ears with Both Fists, (16) Turn Body and Left Heel Kick, (17) Left Lower Body and Stand on One Leg, (18) Right Lower Body and Bird Stand on One Leg, (19) Works at the Shuttle on Both Sides, (20) Needle at Sea Bottom, (21) Fan Through Back, Turn Body, Deflect, Parry, and Punch, (22) Apparent Close Up, (23) Cross Hands, (24) Closing Form.

#### 2.3.3. Wrap-up

Each session was wrapped up with 5 min of meditation and deep breathing.

### 2.4. Tools and methods

#### 2.4.1. Body mass

Height, weight, BMI, skeletal muscle mass, fat mass, and body fat percentage were measured with Inbody 720 (Biospace, Korea) using a bioelectrical impedance analysis (BIA). Measurements were performed during the morning while fasting in comfortable clothing. BMI was calculated by dividing the weight (kg) by the square of the height ($m^2$).

#### 2.4.2. Self-efficacy

Self-efficacy refers to one's belief that he or she can successfully perform a particular behavior in a particular situation.[18] In this study, we used the 10-item scale suggested by Riggs and Knight (1994).[19] Each item was rated using a 5-point scale, with the scores ranging from 5 to 50. A higher score indicated higher self-efficacy. Cronbach's alpha in the Riggs and Knight' study was .79; in our study, it was .84.

#### 2.4.3. Satisfaction with life scale

The satisfaction with life scale is used to assess one's satis-

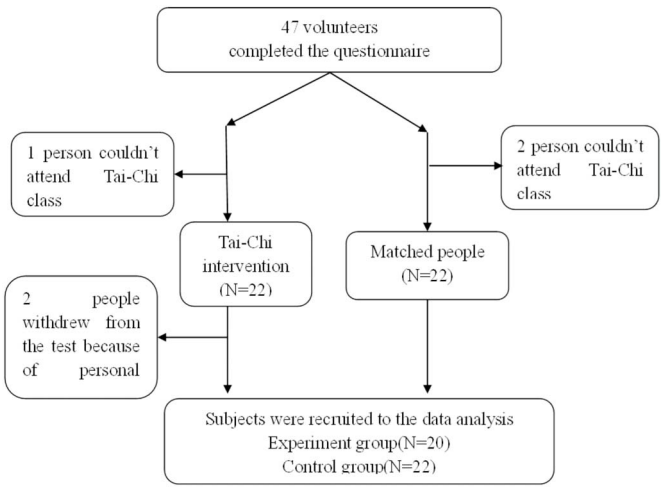


**Fig. 1.** Flowchart of participant recruitment.

faction with his or her life overall; Cronbach's alpha for this scale was .87 in the study by Diencer et el.[20] Ryu[21] adapted the scale for use in Korea, and the reliability of the scale for Koreans was .86 in the study by Kim and Kim.[22] The scale comprises five items, with each item rated using a 7-point scale (1: not at all; 7: very true). Scores range from 7 to 35, with a higher score indicating higher satisfaction with life. Cronbach's alpha was .82 in our study.

#### *2.4.4. Data analysis*

Data were analyzed using SPSS 18.0 software. The normality of the measured variables was verified with the Shapiro-Wilk test. Homogeneity between the experimental and control groups was tested using the $\chi^2$ test, Fisher's exact probability test, t test, and Mann-Whitney U test. Post intervention changes in the two groups were examined using the t test and Mann-Whitney U test.

## 3. Results

### *3.1. General characteristics of participants*

The two groups were found to be homogeneous, with no significant differences in age, sex, marital status, educational level, income, weight, or history of exercise (Table 1).

Furthermore, the experimental and control groups did not significantly differ with respect to pretest measurements of the following dependent variables (Table 2).

### *3.2. Experimental effects*

BMI, fat mass and body fat percentage decreased after the experiment in the experimental group, but it increased after the experiment in the control group, indicating a significant difference between the two groups (Table 3). Change in skeletal muscle mass before and after the intervention was also significant between experimental and control groups (Table 3). Self-efficacy did not change significantly between the experimental and control groups. The difference in life satisfaction was significant between experimental groups (Table 3).

## 4. Discussion

Results from this study showed that the 6-week program of Tai Chi significantly decreased BMI, fat mass, and body fat percentage and increased skeletal muscle mass the in the experimental group and decreased in the control group. The findings of this study are in line with those of previous studies. Tai chi was effective for lowering the body fat, body weight, and BMI of elderly individuals,[11,23] including in a hypertension group.[24] In a study comparing 12 weeks of 24-form tai chi, silver dance, and band exercises for elderly women,[25] tai chi significantly reduced body weight, BMI, and diastolic blood pressure but band exercise did not, suggesting that resistance training or the intensity of the personalized exercise was insufficient to induce increased basal metabolism. Although tai chi training had positive effects on the flexibility, muscle strength, muscle endurance, cardiovascular endurance, and body composition of elderly women,[26] tai chi may be ineffective for inducing changes in body composition parameters.[27]

Tai chi is a low-intensity aerobic exercise with several verified effects.[13,28] The various styles of tai chi are similar, and all movements are performed in the bent-knee posture. Therefore, tai chi requires greater knee muscle activity and weight load than general walking does. However, the height of the posture varies according to the style of tai chi, which leads to differences in muscle activity, weight load, and, consequently, differences in the intensity of the program. The length and frequency of exercises may have an impact on outcomes. Most studies use Sun-style tai chi for patients with musculoskeletal diseases, such as arthritis.[8] However, we used Yang-style tai chi because our study population did not include individuals with functional limitations caused by arthritis or neurological causes. The 24-form tai chi used requires the subject to assume the lowest posture with the hands at medium height. We

**Table 2**
Homogeneity test for dependent variables (N = 42)

| Variable | Exp (n = 20) | Cont (n = 22) | *t* or *Z* | p |
|---|---|---|---|---|
| | Mean ± SD | Mean ± SD | | |
| BMI (kg/m²) | 24.5 ± 3.5 | 24.6 ± 2.6 | -.07[a] | 0.937 |
| Skeletal muscle mass (kg) | 20.9 ± 4.6 | 23.4 ± 4.3 | -1.7 | 0.090 |
| Fat mass (kg) | 19.7 ± 6.5 | 17.6 ± 6.6 | 1.03[a] | 0.307 |
| Body fat (%) | 33.1 ± 7.5 | 28.5 ± 9.84 | 1.69 | 0.099 |
| Self-efficacy score | 22.1 ± 3.4 | 20.8 ± 4.0 | 1.05 | 0.298 |
| Satisfaction with life scale score | 32.0 ± 3.5 | 32.6 ± 4.5 | -.42 | 0.674 |

[a] Mann-Whitney U test.
BMI: body mass index; Exp: experimental group; Cont: control group.

**Table 1**
Homogeneity test for general subject characteristics (N = 42)

| Characteristics | | Exp (n = 20) | Cont (n = 22) | $\chi^2$/t or *Z* | p |
|---|---|---|---|---|---|
| | | Mean ± SD or n (%) | Mean ± SD or n (%) | | |
| Age (years) | | 71.6 ± 6.0 | 70.6 ± 7.0 | .47 | 0.636 |
| Sex | Male | 11 (55.0) | 10 (45.5) | .60 | 0.548 |
| | Female | 9 (45.0) | 12 (54.5) | | |
| Marital status | Married | 15 (75.0) | 15 (68.2) | -.27 | 0.787 |
| | Others | 5 (25.0) | 7 (31.8) | | |
| Education level | Middle school or less | 15 (75.0) | 19 (86.4) | [a] | 0.372 |
| | High school or more | 5 (25.0) | 3 (13.6) | | |
| Religion | Yes | 14 (70.0) | 14 (63.6) | .85 | 0.398 |
| | No | 6 (30.0) | 8 (36.4) | | |
| Economic status | Good | 13 (65.0) | 15 (68.2) | 1.13[b] | 0.263 |
| | Not good | 7 (35.0) | 7 (31.8) | | |
| Body weight (kg) | | 58.0 ± 11.5 | 60.4 ± 6.5 | -.85 | 0.397 |
| Exercise experience | Yes | 11 (55.0) | 10 (45.5) | .00 | 1.000 |
| | No | 9 (45.0) | 12 (54.5) | | |

[a] Fisher's exact probability test; [b] Mann-Whitney U test.
Exp: experimental group; Cont: control group; SD: standard deviation.

**Table 3**
Comparison of dependent variables between groups before and after experiment (N = 42)

| Variables | | Pretest (n = 20) | Posttest (n = 22) | Difference (Pre-Post) | *t* or *Z* | p |
|---|---|---|---|---|---|---|
| BMI(kg/m²) | Exp | 24.5 ± 3.5 | 24.1 ± 3.5 | 0.3 ± 1.0 | 3.02[a] | 0.004 |
| | Cont | 24.6 ± 2.6 | 25.2 ± 2.7 | -0.6 ± 1.0 | | |
| Skeletal muscle mass (kg) | Exp | 20.9 ± 4.6 | 23.2 ± 5.8 | -2.2 ± 2.5 | -4.52 | 0.001 |
| | Cont | 23.4 ± 4.3 | 21.7 ± 3.9 | 1.6 ± 2.9 | | |
| Fat mass (kg) | Exp | 19.7 ± 6.5 | 17.9 ± 6.1 | 1.8 ± 2.8 | 3.84[a] | 0.001 |
| | Cont | 17.6 ± 6.6 | 20.6 ± 7.1 | -3.0 ± 4.9 | | |
| Body fat (%) | Exp | 33.1 ± 7.5 | 30.7 ± 7.9 | 2.3 ± 3.2 | 3.94 | 0.001 |
| | Cont | 28.5 ± 9.8 | 33.3 ± 10.4 | -4.8 ± 7.5 | | |
| Self-efficacy score | Exp | 22.1 ± 3.4 | 22.9 ± 3.8 | -0.8 ± 2.9 | -1.13 | 0.265 |
| | Cont | 20.8 ± 4.0 | 20.8 ± 3.5 | 0.0 ± 1.5 | | |
| Satisfaction with life scale score | Exp | 32.0 ± 3.5 | 36.1 ± 2.9 | -4.1 ± 4.0 | -4.74 | 0.001 |
| | Cont | 32.6 ± 4.5 | 31.6 ± 5.2 | 1.0 ± 2.5 | | |

[a] Mann-Whitney U test.
BMI: body mass index; Exp: experimental group; Cont: control group.

speculated that our tai chi program was able to reduce body weight, fat mass, and body fat percentage because Yang-style tai chi is a moderate-intensity exercise (55% of peak oxygen consumption, 58% of HRR, Heart Rate Reserve) that can increase basal metabolism.[9,11,28,29] Despite the fact that our tai chi program was limited to 6 weeks, the effects of our program on body composition was equal to that of a 12-week or longer tai chi or combined exercise program,[11,24,25,30] possibly because the frequency of our program was relatively high (5 days/week). This should be taken into consideration when planning tai chi exercise frequencies. These findings reflect other studies indicating that combined exercise programs did not induce significant changes in BMI and waist-to-hip ratio but did lead to significant reductions in weight and fat mass while significantly increasing fat-free mass.[30,31] The present study confirmed that tai chi has an impact on body composition by reducing body fat and increasing fat-free mass. Based on these findings, tai chi can be considered a program that has the potential to improve obesity and skeletal muscle mass in the elderly.

The experimental group in our study had significant improvements in satisfaction with life and self-efficacy compared to the control group. These results were in line with previous findings that physical activity bolsters mental well-being[3,26] and that tai chi's unique feature of qigong stabilizes breathing and consciousness, leading to mental and psychological stability and better quality of life.[15,23,28] Additional research is needed to elucidate whether such mental and psychological effects are attributable to the moderate-intensity aerobic exercise provided by tai chi or to the characteristic qigong respiration of tai chi.

## 5. Conclusion and suggestions

This study was a randomized, control group, pretest-posttest, experimental study aimed at investigating the effects of a 6-week 24-form tai chi program (5 days/week) on body composition, self-efficacy, and satisfaction with life for men and women aged 65 years or older living in local communities. Compared to the control group, the experimental group had significantly improved body composition, self-efficacy, and satisfaction with life.

This study has several limitations to a randomized control group pretest-posttest studies, existing possibility of reactive measurement effect, including a small sample size (N = 42), relatively short intervention duration (6-weeks), and the findings cannot be generalized because the participant's individual differences especially diet, activity of living and underline metabolic disease were not controlled for. But this study is meaningful for nursing practice because it verified that tai chi improves body composition and efficiently identified a method of promoting health with psychological benefits for elderly adults. Future studies should be performed to investigate the physiological, mental, psychological, and social effects of tai chi on older adults living in Korea.

## Acknowledgements

None.

## Funding

This study was supported by 2017 Research Grant from Kangwon National University.

## Declarations of interests

None.

## References

1. American Psychological Association. *Between Disciplines & Cultures*. 12th European Congress of Sport Psychology Sport & Exercise Psychology. September 4–9, 2007; Halkidiki, Greece.
2. Jeong YM, Kim JH. An effect of health promotion program on health behavior, perceived health status and life satisfaction in the elderly. *Journal of Korean Academy of Adult Nursing*. 2002;14(3):327–336. [In Korean, English abstract]
3. Ruuskanen JM, Ruoppila I. Physical activity and psychological well-being among people aged 65 to 84 years. *Age Ageing*. 1995;24(4):292–296.
4. Peterson DH, Jones GR, Rice CL. Ageing and physical activity: Evidence to develop exercise recommendations for older adults. *Canadian Journal of Public Health*. 2007;98 Suppl.2:S69-108.
5. Lam P. *What Can Tai Chi Do for You*. 2000. Available at https://taichiforhealthinstitute.org/what-can-tai-chi-do-for-you-2/. Accessed September 30, 2017.
6. Chen KM, Li CH, Lin JN, et al. A feasible method to enhance and maintain the health of elderly living in long-term care facilities through long-term, simplified tai chi exercises. *J Nurs Res*. 2007;15(2):156–164.
7. Rogers CE, Larkey LK, Keller C. A review of clinical trials of tai chi and qigong in older adults. *West J Nurs Res.* 2009;31(2):245–279.
8. Lee HY, Lee KJ. Effects of tai chi exercise in elderly with knee osteoarthritis. *Journal of Korean Academy of Nursing*. 2008;38(1):11–18. [In Korean, English abstract]
9. Taylor-Piliae RE, Haskell WL, Froelicher ES. Hemodynamic responses to a community-based tai chi exercise intervention in ethnic Chinese adults with cardiovascular disease risk factors. *Eur J Cardiovasc Nurs.* 2006; 5(2):165–174.
10. Zhou M, Peng N, Dai Q, et al. Effect of tai chi on muscle strength of the

lower extremities in the elderly. *Chin J Integr Med*. 2016;22(11):861–866.
11. Eom AY. The effects of tai chi exercise on metabolic syndrome and health-related quality of life in middle-aged women. *Journal of Muscle and Joint Health*. 2012;19(2):152–160. [In Korean, English abstract]
12. Hu YN, Chung YJ, Yu HK, et al. Effect of tai chi exercise on fall prevention in older adults: Systematic review and meta-analysis of randomized controlled trials. *Int J Gerontol.* 2016;10(3):131–136.
13. Song RY. Applying tai chi from nursing perspective. *Journal of Nursing Query*. 2006;15(2):106–119. [In Korean, English abstract]
14. Wu SS, Kang DK, Ji HQ, et al. Effect of tai chi exercise on cognitive function and functional fitness in elderly women with dementia. *Exercise Science*. 2015;24(2):169–175. [In Korean, English abstract]
15. Park YJ, Park IH. The effect of tai chi exercise in elderly women. *Journal of Muscle and Joint Health*. 2008;15(2):119–129. [In Korean, English abstract]
16. Layne AS, Hsu FC, Blair SN, et al. Predictors of change in physical function in older adults in response to long-term, structured physical activity: The LIFE Study. *Arch Phys Med Rehabil.* 2017;98(1):11–24.
17. American College of Sports Medicine. *ACSM's Guidelines for Exercise Testing and Prescription.* 8th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2010.
18. Bandura A. *Self -efficacy: The Exercise of Control*. New York, NY: Freeman; 1977.
19. Riggs ML, Knight PA. The impact of perceived group success failure on motivational beliefs and attitude: A casual model. *J Appl Psychol*. 1994; 79:755–766.
20. Diener E, Emmons RA, Larsen RJ, et al. The satisfaction with life scale. *J Pers Assess*. 1985;49:71–75.
21. Ryu YJ. *Effects of Personality and Needs Level on Subjective Well-being*. PhD thesis. Seoul, Korea: Yonsei University; 1996.
22. Kim WS, Kim YJ. The relationship between subjective well-being and social activity. *Korean Journal of Culture and Social Issues*. 1997;3(1):61–81. [In Korean, English abstract]
23. Liu X, Miller YD, Burton NW, et al. A preliminary study of the effects of tai chi and qigong medical exercise on indicators of metabolic syndrome, glycemic control, health-related quality of life, and psychological health in adults with elevated blood glucose. *Br J Sports Med*. 2010;44:704–709.
24. Kim YS, Park MS, Kwak YS. 12 week tai chi exercise on physical fitness, blood pressure, and cholesterol in elderly women. *Journal of Korea Society for Wellness*. 2012;7(1):119–128. [In Korean, English abstract]
25. Son HJ, So WY, Park HM, et al. Effect of a public health center exercise program on physical fitness factors, body weight, body mass index and blood pressure in elderly women. *Journal of Korean Public Health Nursing*. 2011;25(1):17–27. [In Korean, English abstract]
26. Kim WC, Choi SL, Kim SW. The effect of tai chi exercise on skill related fitness and mental health in elderly adult. *Korean Journal of Sports Science*. 2012;24(4):437–455. [In Korean, English abstract]
27. Yu TY, Pei YC, Lau YC, et al. Comparison of the effects of swimming and Tai Chi Chuan on body fat composition in elderly people. *Chang Gung Med J*. 2007;30(2):128–134.
28. Posadzki P, Jacques S. Tai chi and meditation: A conceptual (re)synthesis? *J Holist Nurs.* 2009;27:103–114.
29. Lan C, Chen SY, Lai JS. The exercise intensity of Tai Chi Chuan. *Med Sport Sci.* 2008;52:12–19.
30. Kim JS, Kim SY. The effect of qigong-based combined exercise program for rural elderly people. *The Journal of Korea Society for Wellness*. 2012; 7(2):39–51. [In Korean, English abstract]
31. Bae JC, Kim MK, Kim SC, Kim H. Effects of 16-week combined exercise on body composition, cardiovascular function, and maximal muscle strength in old-old elderly male. *Journal of Exercise Science*. 2010;19(4):381–390. [In Korean, English abstract]