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Silver Yoga Exercises Improved Physical Fitness of Transitional Frail Elders

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- ***Background:*** Promoting the health of transitional frail elders (e.g., through therapeutic-based yoga exercises) is essential to reduce healthcare expenditures caused by chronic health problems.
- ***Objective:*** The purpose of this study was to determine the efficacy of 24 weeks of the senior-tailored silver yoga (SY) exercise program for transitional frail elders.
- ***Methods:*** A convenience sample of 69 elders in assisted living facilities were assigned randomly to the SY group (n = 38) or to the control group (n = 31) on the basis of the facilities where they resided, and 55 of them completed this quasi-experimental pretest and posttest study. Intervention was conducted three times per week, 70 minutes per session, for 24 weeks. Physical fitness (body composition, cardiovascular-respiratory functions, body flexibility, muscle power and endurance, balance, and agility) were examined at baseline, at 12 weeks, and at the end of the 24th week of the study.
- ***Results:*** At the end of the study, the physical fitness indicators of participants in the SY group had improved significantly, and they had better physical fitness than participants in the control group (all p values $< .05$).
- ***Discussion:*** It was recommended that the SY exercises be incorporated as an activity program in assisted living facilities to promote the physical fitness of transitional frail elders.

- ***Key Words:*** aged · complementary/alternative therapy · physical fitness

The aging process typically results in a decline in physical functioning and an increase in the incidence of chronic health problems that could lead to various levels of functional dependency (Chen, Li, et al., 2007). The promotion of good health or health maintenance of elders, especially those in a transitional frail state of health with multiple chronic illnesses and mildly functional dependency, is essential in reducing healthcare expenditures in this fast-growing aging population. Avoiding a sedentary lifestyle is one way to enhance the physical fitness of elders and to delay health deterioration. Innovations in clinical practice, such as applying a therapeutic-based, senior-tailored yoga exercise program to promote the physical fitness of this particular population, would contribute significantly in building a healthier nation.

Theoretical Background

Yoga postures and breathing produce effects different from other exercise programs (Cameron, 2002). Yoga improves body alignment, breathing, circulation, and use of the extremities; these are the major areas in which health problems can occur. Consequently, the vital organs and the endocrine glands become rehabilitated, less energy is consumed, and optimal efficiency is produced (Farrell, Ross, & Sehgal, 1999; Sequeira, 1999). In addition, progression through a sequence of postures improves muscle strength, joint flexibility, and balance. Practitioners of yoga focus on the feedback from the stretch sensors in the muscles, ligaments, and joints to prevent reflex contraction and enhance stretching (Bohle, 1969). Through static physical postures of yoga, stretching improves muscular strength and flexibility (Luskin et al., 2000). The person experiences self-regulation, healing, and well-being (Farrell et al., 1999).

The Silver Yoga Exercise Program

The silver yoga (SY) exercise program is a safe and manageable yoga program developed by Chen, Tseng, Ting, and Huang (2007) to accommodate the reduced body flexibility experienced by many elders. The program includes four phases: (a) warm-up (20 minutes), eight postures to loosen up the body structure; (b) hatha yoga (20 minutes), seven gentle, stretching postures to increase range of motion and progressive muscle relaxation of elders, with special consideration for their physical abilities and tolerance; (c) relaxation (10 minutes), three activities to rest the body; and (d) guided-imagery meditation (15 minutes), two imagery-guiding directions to facilitate a state of relaxation. Abdominal breathing is emphasized in each phase of the program; the postures in the program are considered to be less strenuous than those used in traditional yoga (Chen, Tseng, et al., 2007).

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The SY program was pilot tested with a group of 16 community-dwelling elders in a 4-week intervention period, and positive physical fitness improvements were found (Chen & Tseng, 2008). In a 24-week quasi-experimental pretest and posttest study, the SY exercise program had beneficial effects of decreasing blood pressure and improving lower body flexibility, lower limb muscle endurance, walking speed, and range of motion on both shoulder and hip joints of 176 community-dwelling elders (Chen et al., 2008).

Literature Review

Beneficial physical effects of yoga have been supported by other studies. Yoga can modify cardiovascular risk factors (Damodaran et al., 2002). Schmidt, Wijga, Von Zur Muhlen, Brabant, and Wagner (1997) found a substantial cardiovascular risk factor reduction in a sample of 106 adults after a 3-month yoga training program; participants' body mass index (BMI), total serum, low-density lipoprotein cholesterol, fibrinogen, and blood pressure were significantly reduced. Cowen and Adams (2005) found a decrease in diastolic blood pressure in a sample of 26 healthy adults after participation in 6 weeks of yoga classes. Moreover, use of a yogic breathing technique to improve lung function by reducing the frequency and severity of asthma attacks has been reported (Cooper et al., 2003; Manocha, Marks, Kenchington, Peters, & Salome, 2002).

In addition, Cowen and Adams (2005) found yoga improves flexibility and upper body trunk dynamic muscular strength and endurance of healthy adults. In a sample of 23 healthy elders, ages 62 to 83 years, yoga practice improved their hip extension, increased stride length, and decreased anterior pelvic tilt (DiBenedetto et al., 2005). The researchers suggested that yoga programs tailored to elders may offer a cost-effective means of preventing or reducing age-related changes in gait function (DiBenedetto et al., 2005). Yoga is also useful in treating various forms of arthritis (Dash & Telles, 2001; Garfinkel & Schumacher, 2000), relieving low back–related pain (Galantino et al., 2004; Graves, Krepcho, Mayo, & Hill, 2004; Sherman, Cherkin, Erro, Miglioretti, & Deyo, 2005), and lessening the severity of musculoskeletal disease (Garfinkel & Schumacher, 2000).

Findings from these studies demonstrated the positive physical effects of yoga in older adults, but not specifically in senior-tailored yoga programs. The aim of this study was to examine the efficacy of the senior-tailored SY exercise program for a group of transitional frail elders specifically constructed to test the physical fitness, including body composition, cardiovascular-respiratory functions, body flexibility, muscle power and endurance, balance, and agility of transitional frail elders in assistive living facilities after 24 weeks of this program.

Methods

Design

A quasi-experimental, untreated control group design with pretest and posttest was used. Two assisted living facilities were assigned randomly by site to the SY group or to the wait-list control group. The physical fitness outcomes of the participants were examined at three points in time: at baseline, at 12 weeks, and at the end of the 24th week of the study.

Participants

After approval by the human subject protection committee and the agency administrators, a convenience sample of 69 participants were recruited from two assisted living facilities. Participants were assigned to the SY group ($n = 38$) or to the wait-list control group ($n = 31$) on the basis of the assisted living facilities where they resided. Inclusion criteria of the participants were as follows: (a) transitional frail elders 65 years and older, (b) Barthel Index score of 91 to 99 (mildly dependent level), (c) no previous training in any form of yoga, (d) able to walk without assistance, and (e) Mini-Mental State Examination score of 24 or higher (cognitively intact).

Fifty-five participants completed the 24-week study (retention rate = 80%): 10 participants withdrew by Week 12 of the study (SY group = 6 participants; wait-list control group = 4 participants), and 4 participants withdrew between 13 and 24 weeks (SY group = 1 participant; wait-list control group = 3 participants). Using the Mann–Whitney U or the Pearson χ^2 tests to compare demographic profiles of the participants remaining in the study and those who withdrew from the study in each group, no significant differences were found, which further verified the representativeness of the participants who remained in the study.

Intervention

Participants in the SY group received the SY exercise program as described earlier. Participants were divided into three intervention groups, approximately 12 to 13 participants per group. Two certified SY instructors led each of the group interventions three times per week for 24 weeks. On the basis of previous research experience (Chen, Chen, Wang, & Huang, 2005), certified instructors who were middle-aged (48–60 years old) women were chosen. To make the exercise program a part of regular activities in the facilities, the instructors were staff members or volunteers from the facilities. They were trained and certified by the principal investigator. To ensure intervention consistency across the intervention groups and interrater reliability among the instructors, a prerecorded tape made by the principal investigator was used to verbally guide the intervention process and to direct participants in each yoga posture. It was emphasized that each posture was to be done gently and in moderation. Instructors were required to record any signs or symptoms of discomfort that occurred during any yoga session; no special concerns occurred. The attendance rate of the participants was 80.83%.

The control group participants were instructed to follow their usual daily activities, and they were invited to participate in the SY exercises after the study was completed.

Data Collection

Data were collected from March through October of 2006. The outcome measures of physical fitness included body composition, cardiovascular-respiratory functions, body flexibility, muscle power and endurance, balance, and agility. Body composition included body height, body weight, BMI, and body fat percentage. Body height was measured in centimeters using a tape and a set square while the participants stood straight against the wall without shoes or socks. Body weight was measured in kilograms using a digital body weight scale on a flat floor without heavy coat, shoes, or socks. The BMI was calculated using body weight (in kilograms) divided by body height squared (in meters). Body fat percentage was measured using the digital body fat scale (model TBF521, Tanita Corporation, Kowloon, Hong Kong).

Cardiovascular-respiratory functions included resting blood pressure, heart rate, respiration rate, breath-holding duration, cardiopulmonary fitness, and lung capacity. Resting blood pressure, including systolic and diastolic, was measured using a digital sphygmomanometer (model HEM707; OMRON Corporation, Kyoto, Japan) and recorded in millimeters of mercury. The heart rate and the respiration rate were counted as the number of occurrences in a 60-second period. For breath-holding duration, participants were asked to take a deep breath, hold the breath as long as they could, and then exhale. The duration of breath holding was recorded in seconds. The cardiopulmonary fitness was measured using the 2-minute step test, in which on the signal "go" the participant began stepping (not running) in place as many times as possible for 2 minutes. The frequency of stepping was counted only when both knees were raised to the correct height (midway point between the kneecap and the front hip bone; Rikli & Jones, 2001). Lung capacity of the participants was measured using the TruZone™ Peak Flow Meter (Trudell Medical International, London, Ontario, Canada) and recorded in liters; the participants were asked to take a deep breath and blow air into the meter as fast as they could.

Body flexibility included upper body flexibility, lower body flexibility, and range of motion. Upper body flexibility was measured using the back-scratch test (Rikli & Jones, 2001), in which the participants stood and placed their preferred hand over the same shoulder, palm down and fingers extended, reaching down the middle of the back as far as possible. At the same time, the participants placed the other arm around the back of the waist with the palm up, reaching up the middle of the back as far as possible in an attempt to touch or overlap the extended middle fingers of both hands. The distance between the extended middle fingers of both hands was measured in centimeters: If the middle fingers just barely touched, a 0 score was recorded; the distance of overlapping was recorded as a plus (+) score, and the distance between the tips of the middle fingers was recorded as a minus (−) score (Rikli & Jones, 2001). Lower body flexibility was measured using the chair sit-and-reach test (Rikli & Jones, 2001). The participants were asked to sit on the edge of a chair. One leg was bent with the foot flat on the floor, and the other leg was extended as straight as possible in front of the hip with the heel placed on the floor and with the foot flexed at approximately 90°. Participants were asked to stretch out the arms, hands overlapping, and slowly bend forward at the hip joint reaching as far forward as possible toward or past the toes. The distance from the tips of the middle fingers to the top of the toes was measured in centimeters: The midpoint at the top of the toes represented the 0 point; if the reach was short of this point, the distance was recorded as a minus (−) score, and if the reach was past the midpoint of the toes, the distance was recorded as a plus (+) score (Rikli & Jones, 2001). Range of motion included flexion and abduction of shoulder and hip joints on both sides. Goniometry was used to measure the degree of flexion and abduction. Participants were asked to stand up while the range of motion of the shoulder joints was measured and lie down on a mat while the range of motion of the hip joints was measured.

Muscle power and endurance included handgrip strength, upper limb muscle endurance, and lower limb muscle endurance.

Muscle power and endurance included handgrip strength, upper limb muscle endurance, and lower limb muscle endurance. Handgrip strength was measured using a digital handgrip dynamometer (TKK 5101; Takei Scientific Instruments, Tokyo, Japan) with the dominant hand and recorded in kilograms. Upper limb muscle endurance was measured using the arm curl test (Rikli & Jones, 2001). Participants sat on a chair with back straight and feet flat on the floor and with the dominant side of the body close to the edge of the seat. A dumbbell weight of 8 pounds for men or 5 pounds for women was held down at the side, perpendicular to the floor, in the dominant hand with a handshake grip. From the down position, the weight was curled up with the palm gradually rotating to a facing-up position during flexion. The weight was then returned to the fully extended down position with the handshake grip. The score was recorded as the total number of arm curls executed in 30 seconds (Rikli & Jones, 2001). The chair-stand test was used to evaluate lower limb muscle endurance; participants were asked to stand up and sit down, with arms folded across their chest, using an armless chair. The number of chair stands executed during a 60-second interval was recorded.

Balance was measured with a one-leg-stand test, and agility was measured using the 6-m walk test to detect daily-living functional ability. While doing the one-leg-stand test, participants were asked to stand on a flat surface without shoes or socks, place their hands down by the sides of their body, and lift one leg above the ground 2 to 5 cm with their eyes open. The duration of the one-leg stand, in seconds, was recorded. In the 6-m walk test, the participants were asked to walk in a straight path as fast as they could, reach a predetermined object, turn, and then come back to the start in the same manner. The time spent to complete the task was recorded in seconds.

All of the measurement devices were used frequently in clinical settings with high expert content validity and were used in a pilot study to establish the preliminary evidence of the efficacy and utility of the SY program for elders (Chen & Tseng, 2008) and in a previous study to test the physical health improvements of community-dwelling elders after SY exercises (Chen et al., 2008). Three sequential trial tests were used for each measurement device, and their intraclass correlations were all more than .80. The best performance of the three trial tests was recorded as the score for each measurement device. Further, the physical measurement devices were maintained by the project manager and calibrated for their functions before each data collection to minimize errors.

Data Analysis

The data were analyzed using the Statistical Package for the Social Sciences for Windows (Version 17.0; SPSS Inc., Chicago, IL). Descriptive statistics such as mean, standard deviation, range, and frequency distribution were used to describe the participants' demographic data in each group. The Pearson χ^2 test or Fisher's exact test was used to test group differences in the demographic profiles. The mixed-design, two-way analysis of variance (ANOVA) was used to detect the variables in which time and group had interaction effects. For those variables in which time and group had interaction effects, one-way repeated measures ANOVAs were performed to analyze the simple main effect of different time points in each group. To further understand the group differences at Week 12 and at the end of the 24 weeks of the study, analysis of covariance was computed on those variables in which time and group had interaction effects using the pretest data as the covariate to offset the group differences at the beginning of the study. If the group differences were significant, the Bonferroni *post hoc* tests were used after analysis of covariance for the multiple comparisons (with total $\alpha = .05$).

Results

Participants' Demographic Profiles

A total of 55 participants completed the study: 31 in the SY group and 24 in the control group. The average age of the sample of was 75.40 years (SD = 6.70 years), most of whom were young-old elders (65–75 years; 41.80%) and middle-old elders (76–85 years; 43.60%). Most participants were women (52.70%), widowed (52.70%), and had a 6-year elementary school education or less (81.80%). Most participants lived a healthy lifestyle with no smoking (80.00%) or drinking habits (92.70%), and more than half (58.20%) exercised regularly 3.78 times per week (SD = 3.38 times per week). The cognitive function of the participants was intact, with an average Mini-Mental State Examination score of 25.84 (SD = 3.10). Although the average Barthel Index score of the participants was 99.55 (SD = 1.74; mildly dependent in self-care, such as bathing, eating, or toileting), more than half of the participants (65.50%) had chronic illnesses, with an average number of 1.22 (SD = 1.13), which further indicated that they were in a transitional frail state of health.

Almost all of the demographic profiles of the participants in the two groups were similar, except that the smoking behavior was significantly different between the two groups (Fisher's exact test, $p < .001$). None of the participants in the SY group were smokers; however, almost half of the control group participants were smokers (45.80%).

Baseline Comparisons Between the Two Groups

Results of the t tests indicated that only the respiration rate was significantly different between the participants in the SY group and the control group at baseline ($t = 2.12$, $p = .039$). Participants in the SY group (M = 18.74, SD = 2.21) breathed faster than the control group (M = 17.54, SD = 1.91); however, the average respiration rates were within the normal range. Nonsignificant differences were found between the SY and the control group in the remaining dependent variables (all p values > .05).

Interaction Effects Between Different Time Points and Different Groups

Results of a mixed-design, two-way ANOVA indicated that there were significant interaction effects between three time points and two groups in the following variables: body fat

TABLE 1. Differences Among the Pretest and the Posttest of Those Variables on Which Time and Group Had Significant Interaction Effects in the SY Group (n = 31)

	Pretest		Posttest 1		Posttest 2			
Variable	M	SD	M	SD	M	SD	F (p)	*Post hoc*[a]
Body fat (%)	29.94	10.14	28.54	9.80	28.70	9.27	3.88 (.026)*	*ns*
Respiration rate (times/minute)	18.74	2.21	18.71	1.49	16.68	1.78	11.52 (<.001)**	Pretest > Posttest 2 Posttest 1 > Posttest 2
Upper body flexibility (cm)	−13.12	16.01	−11.98	15.22	−10.87	14.69	2.50 (.105)	–
Lower body flexibility (cm)	−1.53	8.76	−0.77	8.62	0.36	7.64	2.24 (.130)	–
Left shoulder flexion (°)	169.87	14.88	171.77	13.14	172.00	14.56	1.89 (.173)	–
Right shoulder flexion (°)	170.74	15.99	172.71	13.38	173.26	15.30	1.96 (.150)	–
Right shoulder abduction (°)	152.13	27.21	158.90	23.21	162.32	23.45	8.29 (.002)***	Pretest < Posttest 2
Agility (seconds)	8.77	2.36	8.94	4.73	7.52	2.58	2.71 (.095)	–

Note. SY = silver yoga; *ns* = nonsignificant; – = *post hoc* analysis was not performed because of nonsignificant F value.
[a]Bonferroni *post hoc* test (adjusting α levels of multiple tests).
*$p < .05$.
**$p < .001$.
***$p < .01$.

TABLE 2. Differences Among the Pretest and the Posttest of Those Variables on Which Time and Group Had Significant Interaction Effects in the Wait-List Control Group (n = 24)

Variable	Pretest		Posttest 1		Posttest 2			
	M	*SD*	*M*	*SD*	*M*	*SD*	*F* (*p*)	*Post hoc*[a]
Body fat (%)	27.43	9.54	27.85	8.77	29.00	9.03	1.34 (.271)	–
Respiration rate (times/minute)	17.54	1.91	18.46	1.91	18.13	1.96	1.66 (.201)	–
Upper body flexibility (cm)	−17.73	19.17	−18.75	19.51	−19.79	21.00	1.74 (.196)	–
Lower body flexibility (cm)	2.60	12.68	−0.96	9.82	−2.38	11.55	5.18 (.018)*	Pretest > Posttest 1
Left shoulder flexion (°)	165.92	16.37	163.21	19.65	159.71	22.51	2.19 (.124)	–
Right shoulder flexion (°)	166.08	18.09	163.00	19.72	157.67	22.17	3.48 (.047)*	*ns*
Right shoulder abduction (°)	146.92	31.63	143.83	30.82	145.71	32.74	0.47 (.625)	–
Agility (seconds)	8.87	4.85	8.88	4.54	9.50	5.37	1.67 (.200)	–

Note. ns = nonsignificant; – = *post hoc* analysis was not performed because of nonsignificant *F* value.
[a]Bonferroni *post hoc* test (adjusting α levels of multiple tests).
*$p < .05$.

percentage (F = 3.51, p = .039), respiration rate (F = 6.99, p = .002), upper body flexibility (F = 4.13, p = .029), lower body flexibility (F = 8.03, p = .002), left and right shoulder flexions (F = 4.01, p = .021 and F = 5.79, p = .005, respectively), right shoulder abduction (F = 4.71, p = .015), and agility (F = 3.71, p = .036). The rest of the study variables had no significant interaction effects (all p values > .05).

Simple Main Effect of Different Time Points in Each Group

The SY Exercise Group Body fat percentage (F = 3.88, p = .026) and respiration rate (F = 11.52, p < .001) decreased significantly; right shoulder abduction (F = 8.29, p = .002) was significantly enhanced (Table 1). Nonsignificant results were found in the rest of the variables (Table 1).

TABLE 3. Between-Group Differences of the Variables on Which Time and Group Had Significant Interaction Effects at Week 12 in the Study (N = 55)

Variable		Adjusted *M*	*SS*	*df*	*MS*	*F* (*p*)
Body fat (%)	E	27.60	28.38	1	28.38	1.70 (.198)
	C	29.06				
Respiration rate (times/minute)	E	18.61	0.004	1	0.004	0.001 (.970)
	C	18.59				
Upper body flexibility (cm)	E	−13.89	76.95	1	76.95	3.24 (.078)
	C	−16.29				
Lower body flexibility (cm)	E	0.55	135.09	1	135.09	5.80 (.020)*
	C	−2.67				
Left shoulder flexion (°)	E	170.30	356.74	1	356.74	3.98 (.051)
	C	165.12				
Right shoulder flexion (°)	E	171.06	467.99	1	467.99	5.59 (.022)*
	C	165.13				
Right shoulder abduction (°)	E	157.17	1650.34	1	1650.34	7.38 (.009)**
	C	146.08				
Agility (seconds)	E	8.97	0.25	1	0.25	0.02 (.894)
	C	8.83				

Note. E = silver yoga group; C = wait-list control group.
*$p < .05$.
**$p < .01$.

TABLE 4. Between-Group Differences of the Variables on Which Time and Group Had Significant Interaction Effects at the 24th Week of the Study (*N* = 55)

Variable		Adjusted *M*	*SS*	*df*	*MS*	*F* (*p*)
Body fat (%)	E	27.78	75.57	1	75.57	4.48 (.039)*
	C	30.18				
Respiration rate (times/minute)	E	16.77	18.78	1	18.78	5.56 (.022)*
	C	18.00				
Upper body flexibility (cm)	E	−12.75	283.10	1	283.10	5.87 (.019)*
	C	−17.37				
Lower body flexibility (cm)	E	1.47	362.17	1	362.17	7.37 (.009)**
	C	−3.81				
Left shoulder flexion (°)	E	170.44	1013.38	1	1013.38	6.93 (.011)*
	C	161.72				
Right shoulder flexion (°)	E	171.68	1900.59	1	1900.59	10.84 (.002)**
	C	159.71				
Right shoulder abduction (°)	E	160.52	2088.46	1	2088.46	8.59 (.005)**
	C	148.04				
Agility (seconds)	E	7.55	48.82	1	48.82	7.70 (.008)**
	C	9.45				

Note. E = silver yoga group; C = control group.
$^{*}p < .05$.
$^{**}p < .01$.

Wait-List Control Group Unlike the SY group, significant negative changes occurred in lower body flexibility (F = 5.18, p = .018) and right shoulder flexion (F = 3.48, p = .047; Table 2). The participants' lower body flexibility and right shoulder flexion decreased significantly (Table 2).

Two Groups Differences in Each Time Point

Results indicated that participants in the SY group had better lower body flexibility, right shoulder flexion, and right shoulder abduction than the participants in the wait-list control group at the end of Week 12 of the study (F = 5.59, p = .022; F = 5.80, p = .020; and F = 7.38, p = .009, respectively; Table 3). At the end of the final 24th week of the study, the two groups had significant differences in all of the physical fitness indicators (all p values < .05; Table 4). The body fat percentage and the respiration rate of the participants in the SY group were significantly lower than those of the control group. The upper body flexibility, lower body flexibility, left shoulder flexion, right shoulder flexion, and right shoulder abduction of the SY group participants were all better than the control group participants. In addition, participants in the SY group walked faster and had better agility than the participants in the control group (all p values < .05; Table 4).

Discussion

At the end of the study, participants' body fat percentage and respiration rate decreased significantly, and their right shoulder abduction improved significantly. Furthermore, the physical fitness indicators with interaction effects of the participants in the SY group were all better than those in the control group at the end of the study. These findings were congruent with a previous study of the SY exercise program in a group of 176 community-dwelling elders (Chen et al., 2008), indicating that this exercise program is not only beneficial for a healthier community-dwelling elderly population but also appropriate for promoting the health of transitional frail elders.

In the SY exercise program, the postures—such as standing, kneeling, sitting, supine, and prone—were based on six primary types of movements: flexion, extension, hyperextension, abduction, adduction, and rotation, which focused on increasing the participants' range of motion with special consideration for their physical abilities and tolerance (Chen, Tseng, et al., 2007). According to Luskin et al. (2000), through the progression of a sequence of static physical postures, yoga uses stretching to improve joint flexibility and muscular strength, which explicated the findings of this study that body flexibility, range of motion, gait function, and walking speed of the participants improved significantly after SY exercises. Although the program was designed to be low-intensity, circulation was enhanced and body fat was burned through use of whole body movements. Because of using the abdominal breathing technique, participants' breathing became deeper and longer; hence, the respiration rate was decreased.

Nonsignificant results were found in the rest of the variables for the SY group. A possible explanation might be related to the age and educational level of the participants. According to Wang (2007), learning ability is positively correlated with memory, which deteriorates with aging. The average age of this transitional frail elderly population was 75.40 years, and most of them had less than 6 years of elementary education. The learning efficiency of this population needs to be taken into consideration. It does not mean that elders cannot learn; however, it is possible that they need more time to learn new things. Although a prerecorded tape was used to guide each yoga posture and a certified instructor followed the tape to demonstrate the posture, these transitional frail elders possibly needed more time to adjust to this new exercise program and to become more familiar with each posture demonstrated. A longer study period for learning or a larger study sample might have resulted in significant changes.

Although the participants were in a transitional frail state of health (an average of 1.22 chronic illnesses and mild functional dependency), half of them exercised regularly. Although the exercise patterns were not significantly different among the participants in the two groups, without true randomization these exercise behaviors might have confounded the results. A randomized control trial with participants individually randomized to intervention or control groups is needed.

In conclusion, fairly positive outcomes were revealed in this study after applying the SY exercise program in a sample of transitional frail elders. The applications of the program should be further examined by including an old-older adult population or even more frail elders with various functional dependency levels. The SY program could be incorporated as an exercise activity in assisted living facilities or other long-term care facilities to promote physical fitness of institutional elders. The directors of the facilities could recruit volunteers to learn the program and lead the elders to practice in groups in the facilities regularly. It is essential that more exercise-based activities with evidence-based outcomes be incorporated into long-term care facilities to enhance elders' physical fitness and to document health in elders. ▼

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