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Square-Stepping Exercise and Fall Risk Factors in Older Adults: A Single-Blind, Randomized Controlled Trial

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Background. Decreased fitness of the lower extremities is a potentially modifiable fall risk factor. This study aimed to compare two exercise programs—square-stepping exercise (SSE), which is a low-cost indoor program, and walking—for improving the fitness of the lower extremities.

Methods. We randomly allocated 68 community-dwelling older adults (age 65–74 years) to either the SSE or walking group (W group). During the 12-week regimen, the SSE group participated in 70-minute exercise sessions conducted twice a week at a local health center, and the W group participated in outdoor supervised walking sessions conducted weekly. The W group was instructed to increase the number of daily steps. Prior to and after the program, we obtained information on 11 physical performance tests for known fall risk factors and 3 self-reported scales. The fall incidence was followed-up for 8 months.

Results. At 12 weeks postregimen, significant differences were observed between the two exercise groups with respect to leg power (1 item), balance (2 items), agility (2 items), reaction time (2 items), and a self-reported scale (1 item); the SSE group demonstrated a marked improvement in the above-mentioned items with Group × Time interactions. Significant time effects were observed in the tests involving chair stands, functional reach, and standing up from a lying-down position without Group × Time interactions. During the follow-up period, the fall rates per person-year in the SSE and W groups were 23.4% and 33.3%, respectively ($p = .31$).

Conclusion. Although further studies are required, SSE is apparently more effective than walking in reducing fall risk factors, and it appears that it may be recommended as a health promotion exercise in older adults.

Key Words: Functional fitness—Walking—Fall risk—Health status.

WALKING is a widely accepted exercise (1) and is used as a means to develop functional fitness in population-based fall prevention programs (2). However, older adults may experience difficulty in walking in unfavorable weather conditions such as rain, wind, cold, or heat waves. Furthermore, the fear of injury, disease, accident, and crime may prevent them from walking outdoors (3,4).

Considering that older adults face these situations in daily life, we have attempted to develop a square-stepping exercise (SSE) that they can easily perform indoors, composed of movements similar to walking (Figure 1) (5). Walking involves only forward-stepping movements, whereas SSE involves varied movements in multiple directions and is performed on a thin mat (100 × 250 cm) that is partitioned into 40 squares (25 cm each). As suggested in previous studies, corrective steps in certain directions are necessary for recovering balance after tripping in order to prevent a fall (6–8). Therefore, it appears logical to hypothesize that the functional ability of the lower extremities is improved to a greater extent with SSE than with regular walking; thus, SSE is more effective in preventing falls. This study aimed to compare the effects of SSE and regular walking on the fall risk factors in older adults.

Methods

The Institutional Review Board of the Kawage Health Center approved the research protocol. All persons provided written informed consent prior to enrollment in the study. The study complied with the CONSORT (Consolidated Standards of Reporting Trials) checklist for randomized controlled trials.

Participants

Persons aged 65–74 years ($n = 2164$) were recruited from Kawage, Mie, Japan. A letter containing information regarding the schedule of the exercise sessions was sent to 700 noninstitutionalized persons (350 women and 350 men) who were randomly selected community residents from the town of Kawage. After consenting to participate, each person was randomly allocated to either the SSE or walking group (W group) by a public health nurse who used a computerized random number generation program in which the numbers 0 and 1 corresponded to the two groups, respectively. The walking and SSE sessions were conducted on different days. The presence of severe neurological or cardiovascular diseases or mobility-limiting orthopedic conditions was considered as an exclusion criterion.

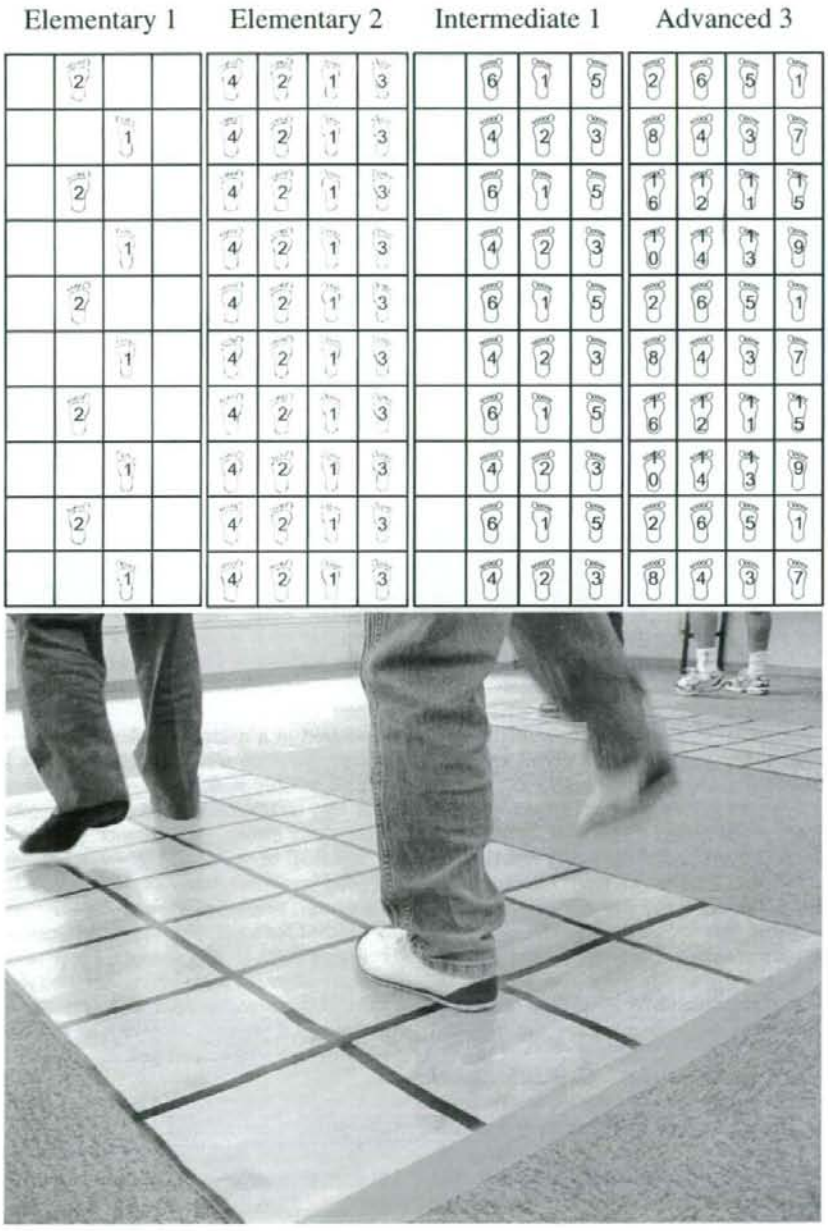

Figure 1. *Top:* Examples of the square-stepping exercise patterns in Elementary 1 and 2, Intermediate 1, and Advanced 3 categories. *Bottom:* Square-stepping exercise.

Outcome Measures

At baseline, the persons completed a questionnaire on vision (5-point Likert scale: 1 = poor and 5 = excellent, higher scores indicate better vision) (9,10); common medical conditions (from among 21 possible common medical conditions such as cerebrovascular disease, hypertension, and heart disease); medication use (yes or no); exercise frequency (4-point Likert scale: 1 = not at all, 2 = once or twice a month, 3 = once a week, and 4 = two or more times a week); and occurrence of falls in the previous year (yes or no). In addition, body weight and height were measured. Body fat was estimated by bioimpedancemetry (HBF-354; Omron Healthcare Co., Ltd., Kyoto, Japan).

The physical performance tests for the fall risk factors

were adopted from previous studies and included the following items: number of chair stands in 30 seconds (11), leg extension power (12), single-leg balance with eyes closed (5), functional reach (13), forward/backward tandem walking over a 20-foot distance (14), standing up from a lying-down position (5), stepping with both feet in 10 seconds [persons stepped as quickly as possible for 10 seconds by using a 60 × 55 cm stepping sheet (TKK 5301; Takei Scientific Instruments Co. Ltd., Niigata, Japan)], walking around two cones (5), vertical jump reaction time after a light signal (simple reaction time) (15), and weight transfer time recorded while stepping in the forward/backward/right/left direction after a light signal (choice reaction time) (16). These tests were conducted by individuals who were unaware of the study group assignment (such as public health nurses other than those involved in the randomization, exercise instructors other than those who served in the regimens, and university students who had specialized in exercise gerontology). Each test was measured by the same staff preregimen and postregimen.

Self-reported scales consisted of the fear of falling (17), perceived health status (18), and pleasure during exercise (using a line scale: left end = not pleasant "0" and right end = very pleasant "100"; higher scores indicate considerable pleasure).

The occurrence of falls and trips was also measured during the 8-month follow-up period at the end of the program. A fall was defined as a sudden unintentional change in position that caused an individual to land at a lower level, that is, on an object, the floor, or the ground, due to reasons other than sudden-onset paralysis, epileptic seizures, or overwhelming external forces (19). A trip was defined as the act of stumbling over an object without landing on any part of the body. Trips may cause false-positive results because some individuals may report a trip as a fall (20); therefore, the persons were explained the difference between a fall and a trip and were instructed to record the occurrence of falls and trips separately on a daily basis. All the persons received a prepaid postcard at the beginning of each month, which they returned at the beginning of the subsequent month. A telephonic or face-to-face interview was conducted to ascertain the reported occurrence of falls and trips.

Pedometers (Walking Style HJ-710IT; Omron Healthcare Co.) were provided to the persons of each group one week prior to the study. During the first week, as a pre-regimen, the persons were instructed to continue their routine daily activities and were advised against performing any new exercises. During the period between preregimen and postregimen, they were instructed to wear the pedometers at all times when awake except when bathing. The recorded number of steps also included those completed during all the exercise sessions.

Exercise Regimen

The SSE group participated in the supervised group sessions twice a week over the 12-week period at the Kawage Health Center; each session comprised 15 minutes of warm-up activities such as stretching and calisthenics, 40 minutes of SSE, and 15 minutes of cool-down activities. A detailed description of the SSE method has been provided in another study (5). In brief, SSE was performed on a thin felt mat (100 × 250 cm) that was partitioned into 40 squares (25 cm each). The persons were instructed to walk (step) from one end of the mat to the other according to the step pattern provided (Figure 1). When the persons reached the end of the mat, they were instructed to return to their start positions by walking normally off the mat and then stand in line for the next stepping. The SSE included forward, backward, lateral, and oblique step patterns. After the persons became familiar with each of these step patterns, they were instructed to walk with their heels lifted, that is, on their toes, without treading on the frames of the squares. Each step pattern was repeated 4–10 times to ensure that the persons could complete the pattern, and was followed by the introduction of a more complex step pattern. In total, 196 step patterns were developed and categorized (based on progressively increasing levels of complexity) into 8 categories (Elementary, 1–2; Intermediate, 1–3; and Advanced, 1–3). The persons were encouraged to concentrate in order to successfully perform each progressively more complicated step pattern. Step cadence was not determined; therefore, the persons performed the pattern at their preferred pace. Although they required 15–20 seconds to complete each step pattern initially, they eventually completed each pattern in < 15 seconds.

The persons in the W group were instructed to attend an outdoor supervised walking session at the Kawage Health Center once a week for 12 weeks. These sessions were structured in a manner similar to that of the SSE sessions except that SSE was substituted with a long-distance 40-minute outdoor walking session. Furthermore, the W group was also instructed to increase the number of daily steps, particularly during long-distance walking.

The SSE ($n = 32$) and W ($n = 36$) groups were further divided into 2 subgroups ($n = 16$ and 18 for the SSE and W subgroups, respectively), and the respective sessions were conducted for each subgroup from December 2004 through February 2005 (winter season). These sessions were always supervised by the same instructors who were certified in first aid and were encouraged to report any negative signs or symptoms that they observed in the persons during the sessions due to the exercises.

Statistical Analysis

An outcome analysis was performed using the intention-to-treat principle, and only two-tailed tests of significance were used. All baseline characteristics were compared between the groups by using the Student t test except for sex, vision, medications (proportion of medicated persons), exercise frequency, and falls in the last year because these characteristics were assessed using the chi-square test. Analysis of covariance (ANCOVA) was used to determine the effect of the exercise program on each of the outcome measures by using the baseline characteristics as covariates. For both groups, the proportional hazards models were used to determine the relative hazards associated with the first fall, and these relative hazards were calculated using the Cox model. SPSS 11.5 software (SPSS Inc., Chicago, IL)

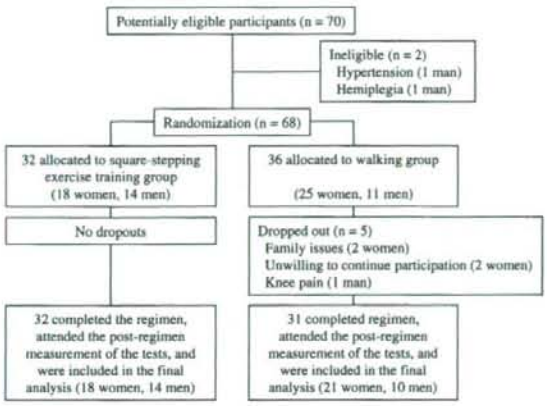

Figure 2. Stagewise progress of the square-stepping exercise and walking groups, including the flow of persons and withdrawals.

was used for all statistical analyses. A value of $p < .05$ was accepted as significant.

Results

Baseline Characteristics and Daily Physical Activity

Of the 70 older adults who consented to participate in the study, 68 were assessed as eligible for the study (Figure 2). Both the SSE and W groups were comparable and well matched with regard to the baseline characteristics (Table 1). The time effect and Group × Time interaction of the daily steps were both significant. The means ± standard errors of the daily average were 7548 ± 453 and 5060 ± 468 at pre-regimen, 7404 ± 493 and 6972 ± 509 at weeks 1–4, 7124 ± 486 and 6773 ± 503 at weeks 5–8, and 6084 ± 505 and 7732 ± 522 at weeks 9–12 for the SSE and W groups, respectively (Table 2).

Table 1. Baseline Characteristics of Study Participants by Randomized Groups

Characteristic	SSE	W	*p*
Female, *n* (%)	18 (56)	25 (69)	.32
Age, y	68.6 ± 2.4	69.5 ± 2.9	.18
Body weight, kg	59.3 ± 11.2	55.6 ± 7.6	.13
Height, cm	157.3 ± 10.0	154.4 ± 6.6	.17
Body fat, %	30.1 ± 5.7	31.5 ± 5.5	.30
Vision*	2.77 ± 0.80	3.09 ± 0.61	.08
Common medical conditions, *n*†	0.97 ± 0.97	0.89 ± 1.11	.75
Medications, *n* (%)	20 (63)	16 (47)	.23
Exercise frequency‡	2.67 ± 1.37	2.76 ± 1.42	.78
Falls in the last year, *n* (%)	8 (26)	5 (15)	.36

Notes: Values express mean ± standard deviation. "Female," "Medications," and "Falls" refer to the number (percentage) of participants who were female, used one or more medications, or had one or more falls in the last year.

*Measured on a 5-point Likert scale: 1 = poor and 5 = excellent; higher scores indicate better vision.

†Measured of 21 possible common medical conditions (e.g., cerebrovascular disease, hypertension, and heart disease).

‡Measured on a 4-point Likert scale: 1 = not at all, 2 = 1 or 2 d/mo, 3 = 1 d/wk, and 4 = ≥2 d/wk.

SSE = square-stepping exercise; W = walking.

Table 2. Daily Steps from One Week Before Regimen and the End of Regimen

Measurement	SSE	W
Pre-regimen	7548 ± 453	5060 ± 468
Weeks 1–4	7404 ± 493	6972 ± 509
Weeks 5–8	7124 ± 486	6773 ± 503
Weeks 9–12	6084 ± 505	7732 ± 522

Notes: Values express mean ± standard error. Time effect and Group × Time interaction were both significant ($p < .001$).

SSE = square-stepping exercise; W = walking.

Adherence and Adverse Effects of the Intervention

The persons in the SSE and W groups attended 21.8 ± 2.9 of 24 sessions (90.9% ± 12.1%) and 9.3 ± 2.6 of 11 sessions (84.2% ± 23.7%), respectively ($p = .15$). None of the persons in the SSE group dropped out of the study, whereas five persons of the W group did (Figure 2). Of these, one of the male persons had developed knee pain due to twisting of the knee during a daily activity (not due to the prescribed walking regimen). The SSE persons conscientiously performed SSE for 40 minutes throughout the regimen. No adverse events such as falls or episodes of fear were experienced by the persons during the sessions. All the persons completed the 8-month follow-up.

Outcomes

The preregimen and postregimen group statistics and Group × Time interactions are presented in Tables 3 and 4. After the 12-week regimen, significant differences were observed between the two exercise groups with respect to leg extension power, forward/backward tandem walking, stepping with both feet, walking around two cones, simple/choice reaction time, and perceived health status with significant Group × Time interactions; the SSE group persons demonstrated a marked improvement in the above-mentioned test items. Significant time effects without Group × Time interactions were observed for three items, that is, chair stands, functional reach, and standing up from a lying-down position; persons of both the groups demonstrated a marked improvement in these tests. Although the number of steps at pre-regimen was statistically higher for the SSE group than for the W group, when this number was included in the analyses as a covariate, the results remained unchanged.

During the 8-month follow-up period, five falls in four persons of the SSE group (fall rate per person-year, 23.4%) and eight falls in seven persons of the W group (fall rate per person-year, 33.3%; $p = .31$) were reported. During the same period, 46 and 60 trips were recorded in the SSE and W groups, respectively, indicating that the rate of falls per trip reported [fall/(fall + trip)] in the SSE group (9.8%) was not significantly lower than that in the W group (11.8%; $p = .50$). The hazard ratio of the W group to the SSE group with respect to the first fall was 2.32 (95% confidence interval [CI], 0.59–9.04; $p = .23$).

Discussion

This single-blind randomized controlled trial was designed to examine whether SSE, which is a novel exercise

Table 3. Functional Fitness Items by Group at Preregimen and Postregimen

Item	Preregimen	Postregimen	Crude Effect (95% CI)	Adjusted Effect (95% CI)*	Group × Time Interaction p Value*	Time Effect p Value*
Leg strength and power						
Chair stands, $n \cdot 30\ s^{-1}$						
SSE	14.6 ± 0.5	15.8 ± 0.5	1.2 (0.4 to 2.0)	1.2 (0.5 to 2.0)	.42	< .001
W	14.7 ± 0.5	16.3 ± 0.5	1.6 (1.0 to 2.3)	1.7 (0.9 to 2.4)		
Total	14.7 ± 0.3	16.1 ± 0.3	1.4 (0.9 to 1.9)	1.4 (0.9 to 1.9)		
Leg extension power, W						
SSE	318.2 ± 21.8	343.0 ± 19.5	24.8 (1.3 to 48.4)	27.4 (6.9 to 47.9)	.03	.14
W	256.0 ± 21.4	253.1 ± 19.1	−2.9 (−20.5 to 14.7)	−5.5 (−26.0 to 15.0)		
Total	286.6 ± 15.7	297.3 ± 14.7	10.7 (−3.9 to 25.4)	10.9 (−3.8 to 25.6)		
Balance						
Single-leg balance with eyes closed, s						
SSE	9.1 ± 1.2	9.9 ± 1.7	0.8 (−2.2 to 3.8)	0.8 (−1.8 to 3.4)	.99	.39
W	7.9 ± 1.2	8.7 ± 1.7	0.7 (−1.6 to 3.0)	0.8 (−1.9 to 3.5)		
Total	8.5 ± 0.9	9.3 ± 1.2	0.8 (−1.1 to 2.6)	0.8 (−1.0 to 2.6)		
Functional reach, cm						
SSE	27.8 ± 0.9	31.4 ± 0.7	3.6 (1.6 to 5.6)	3.5 (1.9 to 5.2)	.06	< .001
W	29.5 ± 0.9	30.6 ± 0.7	1.1 (−0.1 to 2.3)	1.2 (−0.5 to 2.9)		
Total	28.7 ± 0.6	31.0 ± 0.5	2.4 (1.2 to 3.5)	2.4 (1.2 to 3.6)		
Forward tandem walking, s						
SSE	21.1 ± 0.8	16.8 ± 0.8	4.3 (2.8 to 5.9)	4.3 (2.6 to 5.9)	.01	< .001
W	19.0 ± 0.8	18.1 ± 0.8	0.8 (−0.9 to 2.5)	1.0 (−0.7 to 2.6)		
Total	20.0 ± 0.6	17.5 ± 0.6	2.6 (1.4 to 3.8)	2.6 (1.4 to 3.8)		
Backward tandem walking, s						
SSE	26.3 ± 1.2	21.2 ± 1.5	5.2 (3.1 to 7.3)	5.1 (2.2 to 8.0)	.03	.01
W	24.3 ± 1.2	23.9 ± 1.5	0.4 (−3.1 to 3.8)	0.4 (−2.6 to 3.5)		
Total	25.3 ± 0.8	22.5 ± 1.1	2.8 (0.8 to 4.9)	2.9 (0.7 to 5.0)		
Agility						
Standing up from a lying-down position, s						
SSE	3.48 ± 0.27	3.19 ± 0.28	0.30 (−0.02 to 0.60)	0.26 (0.02 to 0.51)	.86	.01
W	3.58 ± 0.27	3.33 ± 0.28	0.26 (0.07 to 0.44)	0.30 (0.04 to 0.55)		
Total	3.53 ± 0.19	3.26 ± 0.19	0.27 (0.10 to 0.45)	0.28 (0.11 to 0.45)		
Stepping with both feet, $n \cdot 10\ s^{-1}$						
SSE	50.9 ± 2.1	60.7 ± 1.9	9.8 (6.9 to 12.7)	10.1 (7.6 to 12.7)	.04	< .001
W	50.6 ± 2.2	57.1 ± 2.0	6.6 (3.9 to 9.2)	6.2 (3.6 to 8.9)		
Total	50.7 ± 1.5	59.0 ± 1.4	8.2 (6.3 to 10.2)	8.2 (6.4 to 10.1)		
Walking around two cones, s						
SSE	24.0 ± 0.7	21.3 ± 0.6	2.7 (1.4 to 3.9)	2.7 (1.7 to 3.7)	.03	< .001
W	21.9 ± 0.7	20.9 ± 0.6	1.0 (0.4 to 1.7)	1.0 (0 to 2.0)		
Total	22.9 ± 0.5	21.1 ± 0.4	1.8 (1.1 to 2.5)	1.9 (1.1 to 2.6)		
Reaction						
Simple reaction time, 1000 ms^{-1}						
SSE	461 ± 14	426 ± 12	35 (11 to 60)	34 (11 to 57)	< .001	.94
W	419 ± 14	453 ± 12	−34 (−54 to −13)	−32 (−55 to −9)		
Total	440 ± 10	439 ± 9	1 (−17 to 19)	1 (−17 to 18)		
Choice reaction time, 1000 ms^{-1}						
SSE	982 ± 15	920 ± 14	62 (35 to 89)	60 (37 to 84)	< .001	.01
W	938 ± 15	954 ± 14	−16 (−36 to 4)	−14 (−39 to 11)		
Total	961 ± 11	936 ± 10	25 (5 to 44)	25 (6 to 44)		

Notes: Values in preregimen and postregimen indicate mean ± standard error.
*Adjusted for baseline characteristics as shown in Table 1.
SSE = square-stepping exercise; W = walking; CI = confidence interval.

program, was more effective than regular walking in improving the functional fitness of the lower extremities in older adults. After the 12-week regimen, we observed that one of the most common risk factors for falls (9)—the functional fitness of the lower extremities—was improved to a greater extent in the SSE group than in the W group. Furthermore, the perceived health status was significantly improved in the SSE group. Our study provides new

Table 4. Self-Reported Items by Group at Preregimen and Postregimen

Item	Preregimen	Postregimen	Crude Effect (95% CI)	Adjusted Effect (95% CI)*	Group × Time Interaction p Value*	Time Effect p Value*
Fear of falling*						
SSE	2.00 ± 0.11	2.22 ± 0.12	0.22 (−0.03 to 0.47)	0.21 (−0.03 to 0.46)	.91	.35
W	2.06 ± 0.11	2.28 ± 0.12	0.22 (−0.01 to 0.44)	0.23 (−0.01 to 0.48)		
Pleasure during exercise†						
SSE	72.3 ± 5.0	90.6 ± 3.1	18.3 (9.9 to 26.7)	18.9 (10.2 to 27.7)	.20	.43
W	78.4 ± 4.9	89.3 ± 3.1	10.9 (2.5 to 19.3)	10.6 (1.7 to 19.5)		
Perceived health status‡						
SSE	2.75 ± 0.13	3.28 ± 0.14	0.53 (0.11 to 0.95)	0.58 (0.24 to 0.91)	.002	.01
W	2.81 ± 0.13	2.69 ± 0.14	−0.13 (−0.34 to 0.09)	−0.21 (−0.55 to 0.13)		

Notes: Values in preregimen and postregimen indicate mean ± standard error.

*Measured on a 3-point Likert scale: 1 = very fearful, 2 = fearful, and 3 = not fearful.

†Measured using a line scale: left end = not pleasant; "0" and right end = very pleasant; "100"; higher scores indicate considerable pleasure.

‡Measured on a 5-point Likert scale: 1 = poor, 2 = fair, 3 = good, 4 = very good, and 5 = excellent.

CI = confidence interval; SSE = square-stepping exercise; W = walking.

evidence that SSE is a more useful exercise program than regular walking for older adults; thus, it may serve as a new form of exercise to prevent falls.

A study by Orr and colleagues (21) revealed that leg-strengthening exercises at light loads (20% of maximal strength) improve balance because they ensure that the muscles remain active throughout the concentric phase of the movement and maintain the level of force output. The exercise intensity and movement in the above-mentioned study were rather similar to those of our step exercises, including the slight extension of the knees and ankles. A leg exercise such as this is assumed to enhance neural function by reducing response latency, effectively recruiting postural muscles, and improving the interpretation of sensory information (21). In addition, the multidirectional steps in the forward, backward, lateral, and oblique directions during SSE lead to better activation of the synergist and agonist leg muscles. Therefore, it is possible that the SSE regimen consequently improves many aspects of the functional fitness of the lower extremities, which is a fall risk factor.

After the SSE persons were familiar with the step patterns, they were instructed to walk with their heels lifted. This movement, which involved small hopping steps, also improved their leg strength (22). A study by Pijnappels and colleagues (8) revealed that during a trip, when the balance of one leg is lost, the other leg is immediately lifted off the floor, in a manner similar to hopping, in order to prevent a fall. This mechanism can explain the reason for the lower number of falls observed in the SSE group than in the W group, as the former appears to have adequate functional ability to prevent falls.

The results of this study imply that SSE could be used as a means of rehabilitation and public health promotion because it has a number of advantages. First, it is possible for fewer staff members (including physicians, public health nurses, and exercise instructors) to simultaneously supervise several older adults with high risk of falling because SSE can be performed within a small indoor space. Second, outdoor walkers can substitute walking with SSE when it rains. In this context, our study proposed a new form of exercise for older adults. Increasing the number of feasible exercises is important for health promotion. Third, SSE requires minimum investment because it involves the use of low-tech equipment. Fourth, because of the significantly small reaction time, which is a cognitive function, SSE may improve information-processing speed and psychomotor processes (23). Based on the results of the current study, we suggest that the variety of step patterns and the level of muscle coordination involved in SSE make it more beneficial than regular walking in reducing fall risk factors. This observation supports the well-known principle regarding specificity of training as the skills targeted by the exercise program were improved. However, walking is known to have beneficial effects on balance and gait speed (24) as well as on cardiorespiratory fitness, blood pressure, and cholesterol levels (25), which were not assessed in this study. Furthermore, from the pedometer readings, we observed that walking could increase the amount of physical activity even during the winter season, whereas SSE might decrease it. Therefore, walking could still be recommended as a health-enhancing form of exercise in older adults.

This study has notable limitations. First, although fall risk factors were lowered in the SSE group, fall rates were not different in the two intervention groups. Furthermore, the occurrence of falls among the elderly adults in each group was not very high. The possible reasons for this observation may be the short follow-up period and the inclusion of persons with a low fall risk. Second, the statistical analysis of each of the 15 outcome measures, including physical performance tests, self-reported scales, and fall occurrence, was performed separately; therefore, there was an increased risk of false-positive findings (type 1 error). The self-reported scales would not be adequately sensitive to a change because each of these scales contained a single item. Third, the pedometer readings revealed that the number of steps in the SSE group was smaller than that in the W group, although our finding is that SSE as an exercise form has a favorable effect on fall risk factors. However, the intensity of the walking regimen, which was not recorded in this study, might not be sufficient to reduce the fall risk. In addition, we did not attempt to standardize the amount of daily activity in the two groups, that is, the W group persons

were advised to walk by themselves without supervision; thus, the effects may reflect the persons' interpretation of and compliance with the prescribed exercise regimen. In the same 12-week period, the supervised SSE sessions were conducted twice a week, whereas the supervised walking sessions were conducted only once a week; therefore, unfortunately, we cannot rule out that better participation in the supervised SSE sessions may have improved the outcome in the SSE group.

Conclusion

The findings suggest that SSE is safe and acceptable, and it improves the functional fitness of the lower extremities, which is a fall risk factor, in older adults. The efficacy of this exercise in improving perceived health status was also substantiated. Therefore, this new activity apparently provides an effective, therapeutic, and health-promoting exercise alternative.

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健康関連 QOL の維持・改善を目指した地域における健康づくりのあり方
—高齢者の体力水準に着目して—

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健康関連 QOL の維持・改善を目指した地域における健康づくりのあり方
—高齢者の体力水準に着目して—

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Yoichi Nakamura[1),2)], Kiyoji Tanaka[3)], Noriko Yabushita[3)], Tomoaki Matsuo[3)], Yoshio Nakata[3)] and Yukako Murotake[4)] : Aiming for improvement in Health-related QOL (HRQL) in promotion of community health. Japan J. Phys. Educ. Hlth. Sport Sci. 53: 137–145, June, 2008.

Abstract : **Objective**: This study aimed to clarify the level of health-related QOL (HRQL) of local elderly persons, and to examine some strategies necessary for a fitness-oriented approach aimed at maintaining and improving QOL levels. **Methods**: The study subjects were 258 elderly persons (101 men, 157 women) living in S city in C prefecture. For the HRQL, the deviation score (50 as a standard value, 10 as standard variation) was calculated using the Short Form-36 (SF-36). This score is standardized with the following six subordinate scales: physical function, bodily pain, general health, vitality, social function, and mental health. To calculate the physical fitness level, a physical score obtained from 11 items that reflect activities which parallel daily living activities (APDL) of elderly persons was used. **Results**: The test results for men showed that HRQL gradually decreased with age, according to the subordinate scales that reflect both physical (physical function and bodily pain) and psychological aspects (social function). In the relationship between the physical score and the HRQL, a significant correlation ($P<0.05$) was observed between subordinate scale scores for both aspects: physical and psychological. The test results for women showed that there was a tendency for only the physical function to decrease with age. No significant age-specific score difference was observed in other subordinate scales. With regard to physical fitness scores, a significant correlation ($P<0.05$) was observed only between the physical subordinate scale scores and the physical fitness scores, whereas no significant correlation was observed between psychological subordinate scores and physical fitness scores. Additionally, these correlations showed similar relationships even when control variables were taken into consideration. When comparing average national deviation scores with those of S city, the results showed low scores in each age class for both men and women, except for the subordinate scale of vitality. **Conclusion**: Physical fitness is a significant factor in maintaining and improving HRQL for older persons, for both men and women, and is a common issue when dealing with the decline in physical fitness associated with old age. Presently in S city, a good environment is being put into place for people to gain 'meaningful life' and 'pleasure' by focusing on construction of local health promotion facilities and developing local community activities. For the future, with the aim of maintaining and improving physical fitness in consideration of the physical aspects of HRQL, it is important to plan and implement specific measures related to local community activities that can provide 'pleasure' and 'meaningful 1ife' for elderly persons.

Key words : elderly person, health-related QOL, functional fitness, health promotion

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I 緒 言

健康日本21（健康・体力づくり事業財団, 2000）およびそれを法的に支える基盤としての健康増進法が制定され，地域での健康づくりは生活習慣病の一次予防に重点が置かれている．現在，この健康日本21を受けた地方計画が都道府県，市町村で策定され，かつその実践が展開され始めている．特に健康づくりに必要となる食習慣，運動習慣，休養（睡眠）習慣などに代表される日常生活習慣の改善は，循環器系疾患，代謝系疾患等の予防に貢献することが考えられ，延いては健康寿命や活力寿命の延伸に繋がると期待されている（田中ら, 2004）．

生活習慣病の一次予防を重視した健康づくりに加え，最近では高齢者に特化した要介護予防や転倒予防など種々の健康づくり事業が増えてきている．その背景として，「生きがい」を反映したクオリティ・オブ・ライフ（quality of life: 以下QOL）の維持・改善を企図した施策の充実が期待されている（濱島, 1994; 田中, 1997; 太田ら, 2001; 田中ら, 2005）．しかしながら，地域全体のQOLの実情を客観的に把握することは必ずしも容易ではなく，またQOLの維持・改善を目指した具体的な健康づくりといっても，それをいかに実践していくかは手探りの状態である．

このような実情のなか，C県S市では高齢者のQOL水準を把握するため，地域コミュニティの協力を得，60歳以上の住民を対象とする質問紙調査を実施した．S市はC県中西部に位置し，沿岸部の臨海工業地帯と内陸部の農業地帯を有する街である．特に今日では，内陸部における保健，医療，福祉関連施策に傾注しつつ，地域コミュニティおよび高齢者に対する健康づくりの充実を図っている．

本研究で得られた調査データについては，年齢階級別（5歳ごと）に分析するとともに，全国平均と比べその差異について明らかにするとともに，今後の健康支援策のあり方について探ることとした．また，体力の水準がQOLにいかなる影響を及ぼすかについても検討した．

II 方 法

A. 対象者

C県S市における健康づくり推進事業の一環として調査協力を要請する中で，質問紙の回答が得られた高齢男女258名（男性101名，平均年齢68.6±5.8歳；女性157名，平均年齢67.3±5.9歳）を分析対象とした．なお，44名（男性：26名；女性：18名）は得点化に必要となる回答が得られなかったため分析から除外した．

B. 調査方法

健康関連QOLは，自記式調査表として36項目からなるShort Form-36（SF-36）日本語版ver. 1.2（Fukuhara et al., 1998a）を用いた．SF-36は，対象者が自分自身の健康についてどのように考えているかをみるもので，身体機能，日常生活の制限，痛み，健康観，バイタリティ（活力），社会的機能，感情・情緒，精神的健康の8つの下位尺度から構成されている．本研究では，他の項目との重複を避けるため，日常生活の制限および感情・情緒を除いた6つの下位尺度について評価をおこなった．下位尺度の得点の解釈については表1に示した（福原と鈴鴨, 2004）．調査対象全体の下位尺度の平均得点を表2に，男女別の平均得点を表3にそれぞれ示した．

C. 体力テストの項目および体力スコアの算出

本研究においては，高齢者の生活関連動作の水準を把握するため体力テストをおこなった．

体力テストは，握力，連続上腕屈伸，連続立上がり動作，長座位体前屈，ファンクショナルリーチ，閉眼片足立ち，8の字歩行，起立時間，落下棒反応，豆運び，ペグ移動の11項目とした．

体力水準を反映する体力スコアは，藪下ら（2004），袖ヶ浦市（2004）の方法を用いて算出した．なお，体力スコアの妥当性については，本研

表1　SF-36下位尺度の得点の解釈

下位尺度	得点の解釈	
	低い	高い
身体機能	健康上の理由で，入浴または着替えなどの活動を自力でおこなうことが，とてもむずかしい	激しい活動を含むあらゆるタイプの活動をおこなうことが可能である
痛み	過去1ヵ月間に非常に激しい体の痛みのためにいつもの仕事が非常にさまたげられた	過去1ヵ月間に体の痛みは全くなく，体の痛みのためにいつもの仕事がさまたげられることは全くなかった
健康観	健康状態が良くなく，徐々に悪くなっていく	健康状態は良い
バイタリティ	過去1ヵ月間，いつでも疲れを感じ，疲れ果てていた	過去1ヵ月間，いつでも活力にあふれていた
社会的機能	過去1ヵ月間に家族，友人，近所の人，その他の仲間との普段の付き合いが，身体的あるいは心理的な理由で非常にさまたげられた	過去1ヵ月間に家族，友人，近所の人，その他の仲間との普段の付き合いが，身体的あるいは心理的な理由でさまたげられることは全くなかった
精神的健康	過去1ヵ月間，いつも神経質でゆううつな気分であった	過去1ヵ月間，落ち着いていて，楽しく，おだやかな気分であった

（福原と鈴鴨，2004）

表2　SF-36（下位尺度）のスコアの平均値（全体）

年齢（歳）	67.8±5.9	n=258
身長（cm）	155.7±8.6	n=258
体重（kg）	57.7±9.7	n=256
体脂肪率（%）	27.2±7.7	n=258
SF-36（0–100）		
身体機能	83.5±15.7	n=258
痛み	74.3±22.1	n=258
健康観	64.6±17.3	n=257
バイタリティ	71.0±19.1	n=258
社会的機能	87.2±19.5	n=257
精神的健康	75.9±18.3	n=258

表3　SF-36（下位尺度）のスコアの平均値（男女別）

項目	男性（n=101）	女性（n=157）
年齢（歳）	68.6±5.8	67.3±5.9
身長（cm）	164.0±5.1	150.4±5.6
体重（k）	64.2±7.9	53.5±8.4
体脂肪率（%）	22.1±5.1	30.5±7.2
BMI	23.6±3.6	23.5±3.8
SF-36（0–100）		
身体機能	86.8±12.6	81.4±17.1
痛み	77.6±19.5	72.2±23.4
健康観	67.2±18.0	62.9±16.6
バイタリティ	72.4±18.6	70.2±19.5
社会的機能	90.8±14.7	85.0±21.7
精神的健康	76.6±18.2	75.5±18.5

表4 年齢階級別にみたSF-36の下位尺度および体力スコアの比較（男性）

項目	60–64歳	65–69歳	70–74歳	75–79歳	80歳以上	F値	多重比較#
対象者数	26	37	22	10	6		
年齢（歳）	62.4±1.2	66.6±1.4	71.9±1.3	77.0±1.5	81.8±1.6	420.46*	60<65<70<75<80
身長（cm）	164.6±4.6	166.6±4.4	162.7±3.8	159.0±5.6	158.5±3.7	9.35*	60, 65>75, 80; 65>70
体重（kg）	64.0±6.4	66.2±6.3	65.4±10.3	56.6±6.9	61.5±9.0	3.46*	65, 70>75
SF-36（0–100）							
身体機能	91.0±10.0	87.1±10.1	88.5±10.5	74.9±20.6	70.8±15.3	4.26*	60, 65, 70>80
痛み	85.7±18.0	76.2±17.0	80.0±17.7	54.0±16.9	81.3±23.6	5.95*	60, 65, 70, 80>75
健康観	74.3±12.8	63.8±18.4	68.8±18.3	56.4±24.7	68.7±10.8	2.44	ns
バイタリティ	76.0±15.5	73.0±18.2	71.1±19.1	61.5±26.5	76.7±14.7	1.22	ns
社会的機能	97.6±6.1	91.6±13.2	93.2±9.2	73.6±21.1	72.9±24.3	9.07*	60, 65, 70>75, 80
精神的健康	80.6±16.8	74.6±17.1	76.7±19.8	71.2±24.6	79.3±14.6	0.67	ns
体力スコア	0.53±0.64	0.36±0.73	−0.35±0.72	−1.19±1.37	−1.27±0.89	15 11*	60, 65>70, 75, 80

* $P<0.05$
ns: 有意差なし
Bonferroni 法

究の全対象者から無作為抽出した者に対して適用し，作成時における同年代の対象者との比較において確認した．

D. 統計解析

SF-36の下位尺度のスコアリングおよび全国平均を基準とした偏差得点の算出は，SF-36 ver. 1.2 スコアリングプログラム（Excel版）を使用した．偏差得点は，全国調査成績（2004年度までの調査）に基づき，基準値＝50，標準偏差＝10として標準化された得点とした．各階層別における項目間の差は，一元配置の分散分析を用い，階層間に有意な差がみられた場合はBonferroni法による多重比較をおこなった．SF-36の各下位尺度得点と体力スコアの関係は，Pearsonの積率相関係数より検討した．また，体力水準との間に有意性がみられた下位尺度スコア毎に相関係数を算出し，相互に有意性がみられたものに関して偏相関係数を算出した．

有意水準はすべて5%以下とした．

III 結　　果

表4は，年齢階級別（5歳ごと）にみた男性のSF-36下位尺度のスコアを示したものである．身体機能においては，60–64歳，65–69歳，70–74歳の階級が80歳以上の階級よりも有意に高いスコアを示した．痛みにおいては，75–79歳の階級が他の階級と比べ有意に低いスコアを示した．社会的機能においては，60–64歳，65–69歳，70–74歳の階級が他の階級よりも有意に高いスコアを示した．

図1は，同階級別にみた男性のSF-36下位尺度別標準得点である．60–64歳の階級では精神的健康（標準得点：48.0点）を除く5つの下位尺度において，65–69歳の階級では身体的健康（49.5点）および健康観（49.9点）を除く4つの下位尺度において，70–74歳の階級では精神的健康（44.5点）を除く5つの下位尺度において，80歳以上では身体機能（38.1点）および社会的機能（42.9点）を除く4つの下位尺度において，それぞれ全国平均より高いスコアであった．一方，75–79歳の階級ではバイタリティ（51.3点）を除く5つの下位尺

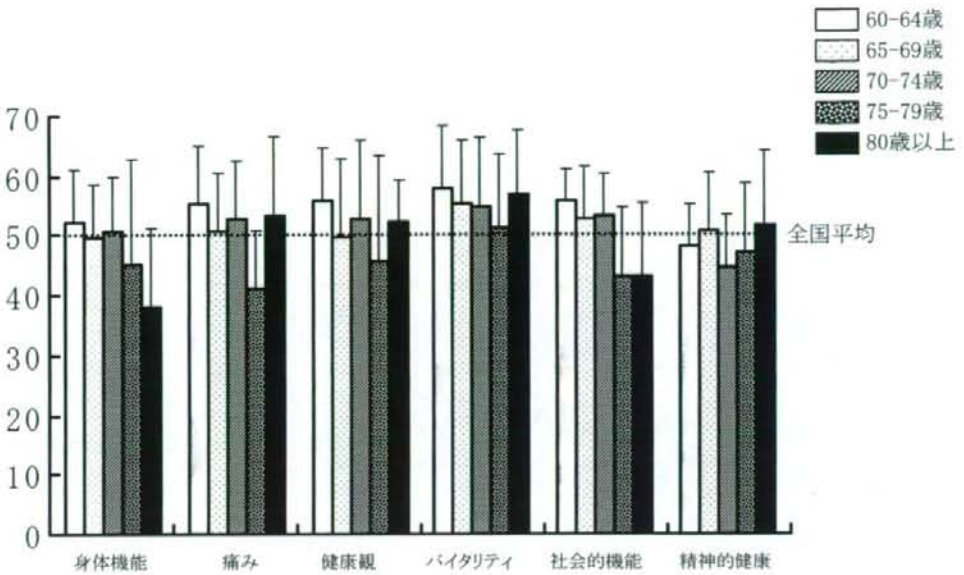

図 1　年齢階級別にみた SF-36 下位尺度別偏差得点（男性）

表 5　年齢階級別にみた SF-36 の下位尺度および体力スコアの比較（女性）

項目	60–64 歳	65–69 歳	70–74 歳	75–79 歳	80 歳以上	*F* 値	多重比較#
対象者数	61	46	27	17	6		
年齢（歳）	61.0±1.4	67.0±1.4	72.2±1.5	76.2±1.1	81.3±1.2	645.72*	60<65<70<75<80
身長（cm）	152.9±4.8	150.8±4.8	148.7±6.1	145.9±4.1	143.6±6.5	10.59*	60, 65>75, 80; 65>70
体重（kg）	54.7±7.9	54.2±8.7	51.7±8.6	50.4±8.5	54.3±8.3	1.28	ns
SF-36（0–100）							
身体機能	88.3±9.6	84.1±15.5	73.9±19.9	68.3±21.5	61.7±18.1	10.63*	60, 65>75, 80; 60>70
痛み	76.1±22.2	73.5±23.7	68.0±23.5	66.8±22.9	55.2±29.8	1.72	ns
健康観	63.2±14.1	61.8±16.3	62.6±18.2	64.7±19.8	66.5±28.2	0.18	ns
バイタリティ	72.6±16.7	69.8±21.2	64.3±18.8	69.4±23.3	76.7±23.4	1.04	ns
社会的機能	88.9±18.3	78.0±26.2	84.3±19.5	86.8±22.7	95.8±10.2	2.17	ns
精神的健康	76.6±17.0	72.3±21.2	76.4±15.6	77.6±19.7	78.0±23.0	0.49	ns
体力スコア	0.62±0.72	0.15±0.75	−0.57±0.65	−0.97±0.75	−2.11±0.84	35.97*	60>65, 75, 80; 65>70, 75, 80; 70>80; 75>80

* $P<0.05$
ns: 有意差なし
Bonferroni 法

度において全国平均よりも低いスコアであった．

表 5 は，年齢階級別（5 歳ごと）にみた女性の SF-36 下位尺度のスコアを示したものである．身体機能においては，60–64 歳，65–69 歳の階級が 75–79 歳および 80 歳以上の階級よりも有意に高いスコアであった．その他の下位尺度においては年齢階級別で有意なスコアの差はみられなかった．

図 2 は，同階級にみた女性の SF-36 下位尺度

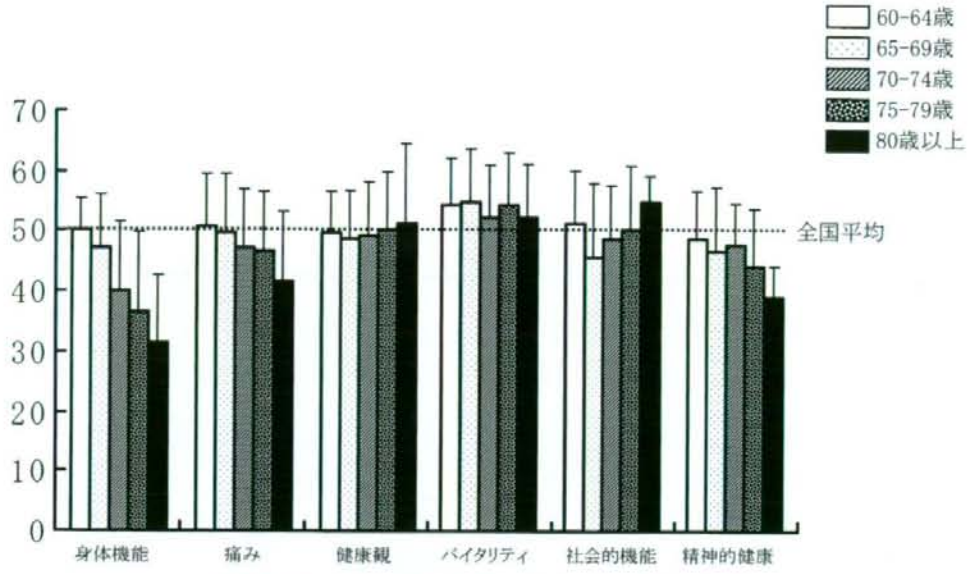

図2 年齢階級別にみたSF-36下位尺度別偏差得点（女性）

別標準得点である．60–64歳の階級では健康観（49.5点）および精神的健康（48.9点）を除く4つの下位尺度において，75–79歳の階級では身体機能（36.3点），痛み（46.7点）および精神的健康（44.1点），80歳以上の階級では身体機能（31.7点），痛み（41.6点）および精神的健康（38.9点）を除く3つの下位尺度において，それぞれ全国平均より高いスコアであった．一方，65–69歳および70–74歳の階級ではバイタリティ（65–69歳：54.8点；70–74歳：52.0点）を除く5つの下位尺度において，全国平均よりも低いスコアであった．

表6は，体力スコアと各下位尺度スコアの相関関係を示したものである．男性において体力スコアとの間に有意な正の相関関係（$P<0.05$）がみられた下位尺度は，身体機能（r=0.42），痛み（r=0.33），健康観（r=0.22），バイタリティ（r=0.24），社会的機能（r=0.43）の5つであり，精神的健康との間に有意な相関関係はみられなかった．

同様に，女性において体力スコアとの間に有意な正の相関関係（$P<0.05$）がみられた下位尺度は，身体機能（r=0.38）および痛み（r=0.19）であり，健康観，バイタリティ，社会的機能および精神的健康との間に有意な相関関係はみられなかった．

表7は，体力水準との間に有意性がみられた下位尺度スコア毎に相関係数を算出し，相互に有意性がみられたものに関して偏相関係数を算出したものである．制御変数を考慮し，体力スコアとの関係をみたところ，男女とも身体機能および痛みとの間に有意性（$P<0.05$）がみられた．

表6 SF-36の下位尺度と体力スコアとの関係（1）

	体力スコアとの相関関係	
	男性	女性
身体機能	0.42*	0.38*
痛み	0.33*	0.19*
健康観	0.22*	−0.03
バイタリティ	0.24*	0.01
社会的機能	0.43*	−0.06
精神的健康	0.12	−0.07

*$P<0.05$

IV 考　　察

健康関連QOLの指標であるSF-36の妥当性とその解釈については，すでに先行研究により示されている（Fukuhara et al., 1998b）．SF-36の下位尺度は大きく身体的要素と精神的要素から構成されて

表 7　SF-36 の下位尺度と体力スコアとの関係（2）

	体力スコアとの偏相関係数		制御変数
	男性	女性	
身体機能	0.35*	0.33*	痛み
	0.38*	0.40*	健康観
	0.37*	0.40*	バイタリティ
	0.34*	0.39*	社会的機能
痛み	0.21*	0.02	身体機能
	0.25*	0.24*	健康観
	0.25*	0.22*	バイタリティ
	0.14	0.22*	社会的機能

*$P<0.05$

おり，本研究で示した 6 つの下位尺度のうち，身体機能および痛みは身体的側面を，社会的機能および精神的健康は心理的側面を，さらに健康観およびバイタリティは身体的および心理的側面の 2 つを併せ持った状態を反映すると解釈されている．

一般に，体力は後期高齢期（75 歳以上）以降で急激に衰える傾向があるため，高齢期の早い段階でそれらの低下に歯止めをかけることが重要である（健康・体力づくり事業財団, 2004）．S 市の男性においても，75 歳を過ぎると体力スコアの著しい低下がみられているが，注目すべきは，健康関連 QOL の身体的側面（身体機能）および心理的側面（社会的機能）の下位尺度においても 75 歳以上から急激にスコアの低下がみられていることである．これは，定年後の身体活動量の減少に伴う体力の低下，さらには活動意欲の減退などが，主観的健康状態の低下，すなわち健康関連 QOL の低下に反映されたものと考えられる（森ら, 2002）．

また，下位尺度の標準得点においても，75 歳以上における身体機能や社会的機能は全国平均に比べて著しく低いこともうかがえたことから，男性においては，体力や QOL の維持・改善を目指した取り組みを高齢早期の段階で実践する必要性があろう．とりわけ，体力は健康関連 QOL の各下位尺度との関係性が高く，その低下は健康関連 QOL に悪影響を及ぼす（中村ら, 2002; 前田ら, 1988）とされ，一方で，複数の体力要素の維持・改善が健康関連 QOL に有益な効用をもたらす（Åstrand, 1992; US Surgeon General, 1996; ACSM, 2000; 川久保と李, 2001）とされていることから，体力を可能な限り高い水準に維持することが，健康関連 QOL の改善に必要な施策といえるであろう．

女性では，階級が高くなるにつれて身体的側面の下位尺度の得点が低下傾向にあるものの，それ以外の下位尺度の得点では階級間に差はみられなかった．また，体力スコアは加齢に伴い低下していくものの，各下位尺度との間に関係性はみられなかった．下位尺度の標準得点においては，全国平均と比べると，バイタリティを除く下位尺度で低い得点がみられ，バイタリティではすべての階級で全国平均よりも高い得点であった．この結果については男性と同様の傾向がみられた．地域コミュニティを対象とした調査では，バイタリティ（活力）ある対象者が比較的多く参加する傾向にあることが報告されており（田中ら, 2004），S 市ではこれが全国平均と比べて高くなったと考えられるが，今後悉皆調査によりその傾向を明らかにする必要があろう．

体力においては，70–74 歳の階級から低下度が大きくなった．健康関連 QOL と体力との関係性については，体力低下が身体的側面を反映する下位尺度の低下をもたらしたと考えられるため，女性においても体力の維持・改善を図っていくことが必要であろう．しかしながら，心理的側面の下位尺度と体力低下との関係性は必ずしも高いとは言えず，体力以外の要素が影響を及ぼしていることがうかがえる（斉藤ら, 2004）．例えば，女性では肥満度の健康関連 QOL（心理的側面）に及ぼす悪影響（Larsson et al. 2002; Le Pen C et al. 1998）や，コミュニティ活動における人間関係の不具合，さらには，社会的地位に関する個人格差の顕在化，などといった体力とは直接関係性の少ない心理社会的要素（吉田ら, 2003）も要因と考えられそうである．実際，多少の個人差はあるものの S 市においても肥満傾向にある者や，社会的機能の下位尺度得点が低い者は，その他の下位尺度得点も低い

傾向にあり，健康関連 QOL の水準は低下している．このようなことから，女性では体力を含めた複数の要素が健康関連 QOL を規定している可能性があるといえよう．

高齢期においては，男女いずれも「健康の維持・改善」が願望の最優先事項（森と北守, 1992）であり，また，ヘルスプロモーションの最終目標は健康関連 QOL を高めることである（土井, 2004）とされており，体力と同時に健康関連 QOL を改善していくことはわが国においても今後社会政策的な意味合いが益々強くなってくると考えられる．今回の調査では，性差の違いはあるものの，身体的側面を反映する下位尺度は，心理的側面を反映する下位尺度に比べて体力スコアとの関連性が高かったことから，体力の維持・改善が健康関連 QOL の維持・改善に繋がると考えられる．

V 結　　論

本研究では，男性における健康関連 QOL と体力との関わりは極めて強く，女性においても，心理的および社会的要素のみならず，体力との関わりは十分考慮する必要が明らかとなった．健康関連 QOL の維持・改善には男女とも体力が強く関わっており，加齢に伴う体力低下に歯止めをかけることは共通の課題といえるであろう．

現在，S 市は内陸部における健康増進施設の建設や地域コミュニティ活動が途上にあり，「生きがい」や「楽しさ」を享受できる環境が整いつつある状況にある．このような中で，健康関連 QOL における身体的側面を考慮しつつ体力の維持・改善を基本目的として，「楽しさ」や「生きがい」が提供でき得るコミュニティ活動や地域性を活かした独自の施策を立案し，着実に実践していくことが重要といえよう．

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追　記

近年，S 市において大規模な健康づくり支援センター（通称：ガウランド）が設立された．当支援センターは，高齢者や障害者を含めた市民全員の健康維持・改善を図るとともに，機能回復，生活習慣病予防，および体力増進に至る幅広い観点に立ち，市民の主体的な健康づくり活動を多面的に支援できうる施設を目指している．なお，現在 S 市，（財）体力つくり指導協会，および筑波大学大学院人間総合科学研究科との連携により，肥満者の減量教室や高齢者の健康づくり教室などが開催されており，多数の市民から好評を得ている．

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投稿

ハイリスク高齢者における「運動器の機能向上」を目的とした介護予防教室の有効性

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目的　現在，新予防給付とともに地域支援事業における特定高齢者施策が自治体レベルで展開されている。しかし，特定高齢者レベルの者を対象とした運動介入の効果に関する報告は少なく，特定高齢者施策における有益な知見の提供が待たれている。そこで本研究では，特定高齢者を含むハイリスク高齢者（将来的に要介護となる可能性の高い高齢者）を対象に，「運動器の機能向上」を目的とした介護予防教室の有効性を身体機能，運動習慣，生活機能の変化より検討した。

方法　ハイリスク高齢者27名（78.4±6.1歳，男性7名，女性20名）を対象とした。週1回のグループ運動と，在宅での運動プログラムからなる介護予防教室を計14週間開催し，事前事後で身体機能および運動習慣，生活機能への変化を比較した。また，運動日誌を配布し，教室中および教室終了後8週間の在宅運動実践状況を確認した。

結果　体力測定10項目中，長座体前屈，ステップテスト，5回いす立ち上がり，Timed up and go，タンデムバランス，タンデムウォーキングの6項目において有意な改善が認められ，運動機能の著しい低下がみられる者の割合も有意に減少した。また，運動習慣を有する者の割合と運動頻度が有意に向上し，介護予防教室終了後8週間にわたって追跡できた11名は，介護予防教室中に比べて一週間当たりの在宅運動実践回数が有意に増加していた。しかし，生活機能には有意な変化がみられなかった。

結論　ハイリスク高齢者における「運動器の機能向上」を目的とした介護予防教室は，身体機能の維持・改善および運動習慣の形成に有効であることが示唆された。その一方で，生活機能への好影響についてはさらなる検討の余地があり，運動に付随する社会的・心理的効果など，身体機能以外の要素をも包括した総合的プログラムによって検討していくことが肝要と考えられた。また，介入終了後も運動習慣および身体機能を維持できるかといった長期的な効果を検証し，3カ月という教室期間が適当であるかについても議論していく必要がある。

キーワード　特定高齢者，介護予防教室，身体機能，運動習慣，生活機能

Ⅰ 緒　　言

現在，わが国は超高齢化社会を迎えており，高齢化率が世界で最も高い国となっている[1]。今後も高齢化率は30%台半ばまで上昇を続けるものと見込まれており，元気な高齢者が増加する一方で，身体的に虚弱な高齢者の絶対数の大幅な増加も懸念される。高齢者の生活の質（Quality of Life 以下，QoL）を良好に保ち，生活そのものを豊かで活力に満ちたものにする

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