

Comparative Analysis of Pain, Muscle Strength, Disability, and Quality of Life in Middle-Aged and Older Adults After Web Video Lower Back Exercise

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This study analyzed the effect of lower back exercise using Web for each age group to use it as nursing intervention. We conducted a randomized experiment with 54 patients with low back pain, composed of 26 middle-aged and 28 older adult people with low back pain who visited a joint center. The participants were instructed to perform the exercise at least twice a day, four times a week. Pain, muscle strength, disability, and quality of life were measured before the exercise intervention, and data were collected again 8 weeks after. The data were analyzed using independent *t* tests, χ^2 test, Fisher's exact tests, repeated measures analysis of variance, and paired *t* tests. The middle-aged and older groups showed differences in pain, muscle strength, disability, and quality of life before and after exercise. In particular, the older group showed statistically significantly larger differences in quality of life compared with the middle-aged group. The results indicated that the effects of the lower back exercises, performed using the Web-based videos, were the same for both the middle-aged and older groups, whereas quality of life showed better improvement in the latter than in the former group. For elderly patients, exercise intervention is an appropriate nursing care to improve the quality of life.

KEY WORDS: Exercise, Lower back pain, Quality of life

Low back pain is a chronic health problem that people often experience in their lives.¹ The occurrence of low back pain increases with age,² and it is the most prevalent among people aged 40 to 80 years³; more than half of older people live with this type of pain. Low back pain can be cured with conservative treatment, but a significant number of acute cases recur again.⁴ Some patients experience disability owing to chronic low back pain.⁵ Moreover, if low back pain has occurred in middle age, the possibility for it to persist in old age will be high. Therefore, intervention in middle age can help prevent low back pain in old age.

Chronic low back pain hinders daily activities, lowers physical functions, and causes psychological problems,^{6,7} such as feeling of helplessness and depression, consequently lowering the quality of life (QOL).⁸ As such, exercise intervention is necessary. The major problems of patients with low back pain are pain, muscle weakening, disability, and deterioration of QOL. Nurses should help patients with low back pain manage these symptoms.

Treatment of low back pain includes exercise therapy when the pain has dissipated to some extent after active medication or physical therapy.⁹ In patients with chronic low back pain, performing exercise helps reduce pain; increases the range of motion; strengthens lumbar muscles; brings about physical improvement, such as increased flexibility; and eases psychological problems, such as depression.¹⁰ Appropriate exercise has positive effects on the muscles, bones, ligaments, cartilage, and intervertebral discs and is helpful in healing damaged tissues.

Exercise is less effective when performed on a one-off basis and must be repeated in daily life. Appropriate lower back exercise that fits individuals' levels is helpful, whereas excessive or incorrect exercise can deteriorate conditions. To help patients perform the exercise properly, nurses educate them on lower back exercise methods upon discharge. However, there are cases where the importance of exercise is forgotten or exercise is not performed properly as time passes, thereby necessitating re-education. In such cases, healthcare using the Web has been proven effective.¹¹ The Web exercise video for the lower back used in this study was designed to help patients perform lower back exercises consistently in daily life. Using the Web, patients could easily follow the exercise while watching the video. This intervention was

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developed for patients with chronic low back pain. Web exercise videos are useful for both patients and nurses because they can be used without temporal or spatial restrictions.

Meanwhile, although exercise is mainly used to relieve back pain, limited evidence is available about the effectiveness of commonly recommended treatments for the older adults with lower back pain.¹² As such, the relevant facts should be checked. Many comparative studies on various exercise methods have been reported, but few studies have compared the effects of exercises between age groups. Our study aimed to compare and analyze the effects of lower back exercises in middle-aged and older patients with a view to providing a basis for the exercise intervention.

METHODS

Study Design

This study analyzed the effects of a Web exercise video for the lower back on the pain, muscle strength, disability, and QOL of middle-aged and older people with chronic lower back pain.

Study Participants

We explained the contents of the study to middle-aged (40-59 years old) and older (65-79 years old) patients who visited a clinic for chronic low back pain. In general, 65 years of age or older are regarded as senior citizens, but since there is a tradition in Korea that people over 60 years old are regarded as senior citizens, those aged 60 to 64 years are excluded. The study subjects were selected from those who wish to participate in the study among patients who visited the outpatient clinic of orthopedic surgery at a university hospital in Korea for the treatment of chronic low back pain.

The participants were selected based on the following criteria:

- Those who agreed to participate in the study;
- Those who had experienced low back pain for at least 6 months and had not been receiving low back pain treatment;
- Those who were not regularly performing systematic exercise at the time of selection;
- Those who had no serious spinal pathology such as tumors, fractures, inflammatory disease, previous spinal surgery, nerve root compromise in the lumbar region, or neurological disorders; and
- Those who could use the Web or smart phone.

The number of participants required to performed the repeated measures analysis of variance was calculated using G*Power (Heinrich Heine University, Dusseldorf, Germany).¹³ When the effect size was set to 0.25, α value to .05, number of groups to 2, number of times of measurement to 2, and power to 0.95, the total number of participants required was 54. In consideration of the dropout rate, we included 56 persons in the sample. Two participants (one older and

one middle-aged) were excluded for moving. Thus, the final sample consisted of 54 participants (26 middle-aged and 28 older persons).

Study Instruments

Pain

Spine and leg pain were measured with the 10-centimeter visual analog scale.

Muscle Strength

Lumbar muscle strength was measured using a back muscle dynamometer (TKK-5402, Takei, Japan). For the measurement, participants were asked to stand on the foot step of the measuring machine with the string placed between their two feet, adjust the string to the extent that it could be touched by the fingertips when the two arms were extended, straighten their knee joint and chest, and bend the waist forward to hold the handle firmly (the incline of the upper body was at 30°). After taking such a posture, they were asked to pull up the handle with all their strength while slowly straightening their back. Muscle strength was measured in this manner two times, and the higher measured value was used. The unit was kilograms (kg), and the average values (male/female) by age group presented by the manufacturer were as follows: 138/84.4, 125/78, 97/59.6, and 84/40 kg for people in their 40s, 50s, 60s, and 70s, respectively.

Oswestry Disability Index

Disability refers to the disability experienced in daily life owing to low back pain. In this study, disability was measured using the instrument translated by Jeon et al¹⁴ that modified and supplemented the Oswestry Disability Index developed by Fairbank et al.¹⁵ Higher scores indicate more disabilities experienced in daily life owing to low back pain: pain, personal hygiene, lifting, walking, sitting, standing, sleeping, social life, sex life, and travel. The method of scoring was set as presented by Fairbank and Pynsent.¹⁶ According to the calculated score, the levels of disability were identified as follows: minimal, 21% to 40%; moderate, 41% to 60%; severe, 61% to 80%; and crippling, 81% to 100%. The reliability of the instrument was Cronbach's $\alpha = .86$ in Fairbank and Pynsent¹⁶ and was Cronbach's $\alpha = .85$ in this study.

Quality of Life

QOL was measured using the Korean version of the World Health Organization QOL brief version, which was designed by Min et al¹⁷ by standardizing the QOL scale of the World Health Organization QOL Group.¹⁸ This instrument consists of 26 items across broad areas: physical health (seven questions), psychological area (six questions), social relations (three questions), environmental area (eight questions),

and overall QOL (two questions). Each question was measured with a 5-point Likert scale in which 1 = “not at all so” and 5 = “very much so.” In the case of negative questions, the scores were calculated by subtracting the score of the corresponding question from 6 points. The total score ranged from 26 to 130 points, with higher scores indicating higher QOL. The Korean version of the World Health Organization QOL brief version instrument translated by Min et al¹⁷ had a Cronbach's $\alpha = .86$ at the time of development. In this study, Cronbach's α was .85.

Web Exercise Video for the Lower Back

The Web exercise video for the lower back was developed using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) to promote exercise in patients who visited the hospital for low back pain. The intervention used in this study is the Web exercise video described in the study¹¹ reference citation titled “Development of a Web Exercise Video for Nursing Intervention in Outpatients with Low Back Pain.” A researcher, who is an educational nurse at the joint center, designed an exercise video and conducted training and monitoring of the subjects. The educational nurse is responsible for leading the exercise practice so that the patients perform the exercises appropriately.

In the development process, the demands related to exercise and preferred exercise methods were identified through literature review and interviews with 10 patients with low back pain. The participants were motivated but had difficulty in performing the exercises. They also reported that the existence of an exercise video would help them.

The content of the exercise video was determined through literature review and expert advice. The exercise motions focused on flexibility and muscle strengthening. The motions included “lying down and bending one knee,” “lying down and bending both knees,” “lifting the buttocks,” “lying face down and straightening the low back,” “kneeling and straightening the low back,” “kneeling and raising the opposite limbs,” and “sitting and stretching by rotating.”¹¹

Before starting the exercise intervention, all participants were taught the exercises and informed of the importance of exercising. We provided information on low back pain management and exercise methods before the start of the exercise intervention to guide the participants in performing the exercises properly as well as help them recognize the necessity of exercising and be motivated to perform the exercises consistently.

The participants were instructed to perform the exercises twice a day. They were also told to stop the exercises and contact the researcher to receive medical treatment in cases where they experienced severe pain or any other symptom during exercise. The exercise took 15 to 20 minutes per session. Education on exercise motions was provided before

starting the exercise, and the researchers checked whether the exercise was performed correctly thereafter.

Ethical Considerations

We explained the purpose of the study to the patients who wished to participate and asked them to sign the written consent to participate. The study was conducted after obtaining permission from the institutional review board. Those who wished to participate but were not included in the intervention were given opportunities to perform the exercises after the study was completed.

Study Procedure and Data Collection

We randomly selected participants for the exercise intervention from among the patients who wanted to participate in the study through a notice board. After dividing the subjects into middle-aged and old-aged groups, numbers were randomly assigned, and exercise videos were applied to subjects with odd numbers for the middle-aged group and even numbers for the elderly group.

Before starting the exercise, the participants received explanation on how to watch the lower back exercise Web videos, the importance of exercise, and how to perform the exercises so that they could perform the exercises properly. The explanation and education were provided by researcher. The participants performed the exercises at least twice a day, four times a week, while watching the lower back exercise Web videos.

Pain, muscle strength, disability, and QOL were measured before the participants started performing the exercises, and data were collected again when the participants visited the hospital 8 weeks after starting the exercise program. The 8-week interval was based on previous results^{19,20} that lower back exercises are effective when performed for 8 weeks. The measurements were carried out by one research assistant at the same time of the day (14:00-16:00) to reduce measurement errors. Participants' exercise performance was confirmed via mobile phone text message. Research assistants monitored all the participants' exercise performance via text messages twice a week.

Statistical Analyses

The data were statistically analyzed using IBM SPSS Statistics version 24.0 (IBM Inc, Armonk, NY, USA). Data from 26 middle-aged and 28 older adult participants were analyzed. The general characteristics and variables of the two groups were presented as frequencies, percentages, and mean values. We used independent *t* test, χ^2 test, and Fisher's exact test for the homogeneity analysis of the two groups. Repeated measures analysis of variance was used to analyze differences in lower back pain, leg pain, disability, muscle strength, and

QOL between the groups over time. Paired *t* tests were conducted for differences in QOL subareas.

RESULTS

General Characteristics of the Participants and Homogeneity Test

Table 1 shows the results of the homogeneity tests for the general characteristics (sex, age, sleeping hours, living characteristics, health condition), back pain, leg pain, pain period, muscle strength, disability, and QOL of the middle-aged and older groups. A total of 54 persons consisting of 26 in the middle-aged group and 28 in the older group participated in the study. The mean age of the middle-aged group was 57.88 years, and that of the older group was 72.07 years. We found no statistically significant difference in back pain ($t = 0.63, P = .532$), leg pain ($t = 0.20, P = .844$), muscle strength ($t = 1.21, P = .232$), and disability ($P = .455$) between the two groups. The QOL score was significantly lower in the older group: 76.2 and 67.8 points in the middle-aged and older groups, respectively ($t = 2.53, P = .014$).

Differences in Variables After Exercise in the Middle-Aged and Older Groups

Pain

Regarding the effects of the exercise program on low back pain, no interaction appeared between the groups or between time and groups, whereas significant differences

appeared between time points ($F = 42.45, P = .000$). The average low back pain score decreased from 58.85 to 48.08 in the middle-aged group and from 56.07 to 46.43 in the older group; we found no differences between the two groups. In the case of leg pain, no interaction appeared between the groups or between time and groups, but significant differences appeared between time points ($F = 28.55, P = .000$). After the exercise intervention, leg pain decreased in both groups. The average leg pain score decreased from 51.54 to 43.85 in the middle-aged group and from 50.71 to 37.14 in the older group (Table 2).

Muscle Strength

Regarding muscle strength, no interaction appeared between the groups or between time and groups. Meanwhile, significant differences appeared between time points ($F = 55.32, P = .000$). The measured value increased from 51.35 kg to 58.54 kg in the middle-aged group and from 44.59 kg to 54.51 kg in the older group (Table 2).

Disability

Regarding disability, no interaction appeared between the groups or between time and groups. Significant differences appeared between time points ($F = 33.23, P = .000$). The measured value decreased in both groups from 27.1% to 23.2% in the middle-aged group and from 28.9% to 24.3% in the older group (Table 2).

Table 1. Homogeneity Test Between Middle-Aged and Older Participants

Variable	Category	Middle Aged	Older	T or χ^2	P
		M \pm SD/n (%)	M \pm SD/n (%)		
Sex	M	4 (15.4)	8 (28.6)	1.36	.202
	F	22 (84.6)	20 (71.4)		
Age		57.88 \pm 5.61	72.07 \pm 4.47	-10.31	.000
Sleep duration, h		6.27 \pm 0.78	6.25 \pm 1.23	0.07	.946
Working posture	Sitting	12 (46.2)	11 (39.3)	3.85	.282
	Squatting	6 (23.1)	4 (14.3)		
	Standing	7 (26.9)	7 (25.0)		
	Others	1 (3.8)	6 (21.4)		
Back pain		58.85 \pm 11.77	56.07 \pm 19.88	0.63	.532
Leg pain		51.54 \pm 15.15	50.71 \pm 15.38	0.20	.844
Pain duration, mo		31.15 \pm 31.89	32.07 \pm 32.74	-0.10	.917
Health status		2.96 \pm 0.52	2.86 \pm 0.80	0.57	.573
Muscle strength		51.35 \pm 16.70	44.59 \pm 23.49	1.21	.232
Disability ^a	0–20: minimal	6 (23.1)	7 (25.0)		.455
	21–40: moderate	19 (73.1)	19 (67.9)		
	41–60: severe	1 (3.8)	2 (7.1)		
QOL		76.23 \pm 12.67	67.82 \pm 11.74	2.53	.014

Abbreviations: F, female; M, male.

^aFisher's exact test.

Table 2. Changes in Variables in Middle-Aged and Older Groups After 8 Weeks of the Exercise Program

Variables	Group	Pre-test M ± SD	Post-test M ± SD	Source	F	P
Back pain	Middle (n = 26)	58.85 ± 11.77	48.08 ± 10.59	Time	42.45	.000
	Older (n = 28)	56.07 ± 19.88	46.43 ± 13.11	Group × Time	0.13	.721
				Group	0.38	.541
Leg pain	Middle (n = 26)	51.54 ± 15.15	43.85 ± 12.67	Time	28.55	.000
	Older (n = 28)	50.71 ± 15.38	37.14 ± 8.54	Group × Time	2.18	.140
				Group	1.58	.214
Muscle strength	Middle (n = 26)	51.35 ± 16.71	58.54 ± 17.31	Time	55.32	.000
	Older (n = 28)	44.59 ± 23.49	54.51 ± 22.40	Group × Time	1.40	.241
				Group	0.99	.324
Disability	Middle (n = 26)	27.08 ± 9.11	23.23 ± 6.81	Time	33.23	.000
	Older (n = 28)	28.87 ± 8.88	24.25 ± 7.39	Group × Time	0.28	.597
				Group	0.46	.503
QOL	Middle (n = 26)	76.23 ± 12.67	78.73 ± 11.12	Time	28.78	.000
	Older (n = 28)	67.82 ± 11.73	73.46 ± 10.41	Group × Time	4.29	.043
				Group	5.07	.029

Quality of Life

Regarding QOL, we observed interactions between time points ($F = 28.78, P = .000$), between groups ($F = 5.07, P = .029$), and between time points and groups ($F = 4.29, P = .043$). QOL increased significantly more in the older group compared with the middle-aged group, with an increase in score from 76.23 to 78.73 in the middle-aged group and from 67.82 to 73.46 in the older group (Table 2).

The middle-aged group in our study showed improvement in the physical and environmental subareas of QOL, whereas the older participants showed improvement in the physical, psychological, social, and overall (Table 3).

DISCUSSION

This study was conducted to verify the effects of a Web exercise video program for the lower back on the pain, muscle strength, disability, and QOL of middle-aged and older individuals who visited a joint center for chronic low back pain. In this study, when the lower back exercises were performed

for 8 weeks, low back pain was significantly relieved in both age groups, thereby supporting previous results¹⁹⁻²¹ and indicating that exercise intervention for 8 weeks is effective for low back pain relief. Considering the report¹² that a 4-week program has no effects on pain, we inferred that the effects may manifest in the fourth to eighth weeks of exercise. However, although leg pain (radiating pain) was significantly relieved in both age groups after 8 weeks of exercise in our study, no significant difference in leg pain was reported in a study²⁰ that also used an 8-week exercise duration but in a sample aged 32 to 54 years. The difference in results may be because exercise methods represent a more important element than exercise duration. The exercise regimen in the previous study²⁰ was composed of lumbar extension motions without any lumbar flexion motions. Meanwhile, our exercise regimen included motions that could strengthen the lower extremity muscles. Changes in low back pain and leg pain must be analyzed according to the lower back exercise methods through repetitive studies.

Table 3. Analysis of the Sub-areas of QOL

Variables	Group	Pre-test M ± SD	Post-test M ± SD	Paired t	P	Effect Size
Physiological	Middle (n = 26)	2.80 ± 0.50	2.95 ± 0.54	-2.50	.019	0.49
	Older (n = 28)	2.59 ± 0.48	2.87 ± 0.44	-5.15	.000	0.97
Psychological	Middle (n = 26)	3.10 ± 1.01	3.14 ± 0.42	-0.17	.868	0.03
	Older (n = 28)	2.59 ± 0.54	2.95 ± 0.48	-6.16	.000	1.17
Social relation	Middle (n = 26)	2.94 ± 0.64	3.06 ± 0.58	-1.29	.210	0.25
	Older (n = 28)	2.46 ± 0.62	2.81 ± 0.45	-4.35	.000	0.83
Environment	Middle (n = 26)	2.89 ± 0.50	2.98 ± 0.49	-2.15	.041	0.42
	Older (n = 28)	2.62 ± 0.49	2.60 ± 0.42	0.25	.808	0.05
Overall	Middle (n = 26)	3.02 ± 0.57	3.15 ± 0.46	-1.66	.110	0.33
	Older (n = 28)	2.98 ± 0.63	3.21 ± 0.46	-2.93	.007	0.55

The lower back exercises used in this study included stretching and muscle strengthening exercises to strengthen the external oblique rotators, internal oblique rotators, piriformis gluteal muscles, hamstrings, back extensors and erector spinae, and quadratus lumborum through flexion and extension of the lower back joint.²² Stretching and lumbar muscle strengthening have the advantage of being easy to perform for patients with low back pain. Our results provided a basis for practical application in nursing situation.

We found lower back exercises to be effective in enhancing muscle strength in both the middle-aged and older groups. A previous study²¹ has reported similar findings of enhanced muscle strength in participants after 8 weeks of McKenzie exercises. Another study²² reported improved muscle strength after 5 weeks of exercises, including regeneration and stretching of the lumbar and leg muscles and a sense of balance. Thus, exercise is effective for increasing muscle strength in patients with low back pain. Exercise that leads to the strengthening of the lower limb muscles is required for patients with low back pain because these muscles are weak²³ in these patients. Moreover, the lower limb muscles, including those in the hips, play an important role in the safety of the lumbar region in patients with low back pain. Low back pain is related to lower limb muscle strength; weakening and imbalance of the lower lumbar muscles, quadriceps, and hamstring muscles of the lower limbs play an important role in low back pain.²⁴

Patients with chronic low back pain have shown changes in pelvic rhythm owing to delays or decreases in gluteal maximus muscle activity as pain avoidance reactions.²⁵ If this condition persists, gluteal muscle weakening may occur, and the compensatory action of the pelvis causes stress around and pain in the low back. Compared with normal persons, patients with low back pain have reduced muscle strength of the gluteus medius muscle.²⁶ The decline in gluteal muscle functions causes instability of the pelvis, and the weakening of the gluteal muscle causes crippled walking, or walking with the pelvis tilting to the left and right.

For a clear identification of the effects of exercise motions, objective physical variables, such as muscle flexibility, muscle strength, and changes in waist circumference, should be evaluated. Both age groups in our study showed significant differences in disability after lower back exercises, confirming previous reports^{19,27} of exercises significantly reducing disability in patients with low back pain. The Oswestry Disability Index, which was used in our study, accounts for pain, personal hygiene, object lifting, walking, sitting, standing, sex life, social life, and travel. Therefore, it is sensitive to functional disabilities of the low back and can reflect functional disabilities.

In this study, lower back exercises were found to improve QOL in the middle-aged and older groups, with larger changes in the latter. A study¹² that compared QOL after

4 weeks of exercise reported no differences in QOL attributable to exercises. Other studies have found improvement in QOL after 4-week²⁸ and 5-week²² exercise programs. Given the differences in the time of manifestation of effects in relation to QOL according to exercise periods, more studies are required. Exercise has the advantage of not only relieving pain but also improving overall physical and mental health.²³ In particular, older adults experience pain, disability, and psychological relief through exercising. The larger changes in QOL in older adults may be because their lives tend to be affected more by exercising compared with middle-aged adults, with respect to pain or disability relief. Indeed, the middle-aged group in our study showed improvement in the physical and environmental subareas of QOL, whereas the older participants showed improvement in the physical, psychological, and social areas. The reason may be that when movement and travel become easier through exercise, daily living activities increase, in turn affecting QOL.

The results indicated that when the exercise program was applied in older adults, the effects were the same as those in middle-aged persons. The better improvement in QOL among the older than the middle-aged persons indicates that exercise management is appropriate for older adults. Moreover, different exercise programs do not need to be devised for middle-aged and older adults, although the long-term effects of exercise need to be analyzed according to the method or duration of exercise. The effect sizes of the physical area for QOL were 0.49 and 0.97 in the middle-aged and older groups, respectively. Among the sub-areas of QOL, the psychological and social areas were also smaller in the middle-aged group and larger in the elderly group. Exercise has 1.16 and 0.83 effect sizes in the psychological and social domains of QOL, respectively. We also showed that stretching and muscle strength exercises could relieve pain and disability and improve muscle strength and QOL in patients with chronic low back pain. Differences in effect according to exercise method and duration should be checked for creating standardized exercise protocols.

A limitation of this study was that information on whether exercise was performed relied on the participants' reports. Nonetheless, the participants reported information with integrity because they knew the importance of correct reporting. Meanwhile, a strength of this study was that the participants reported an increased likelihood for performing exercises owing to the exercises being accessible through a mobile phone. This finding provides nursing implications for exercise management using the Web. In a highly information-oriented society, providing opportunities for nursing management that utilize nursing informatics fits the trend of the age: information can help maintain personal health, promote IT technique development, and boost medical efficiency.

CONCLUSION

This experimental study compared and analyzed the effects of lower back exercises delivered via Web video on the back pain, leg pain, muscle strength, disability, and QOL of middle-aged and older people with chronic low back pain. Pain, muscle strength, disability, and QOL were measured in 26 middle-aged and 28 older persons with low back pain. The Web exercise video for the lower back used as a nursing intervention in this study was developed using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) to promote exercise in patients who visited the hospital for low back pain. The content of the program was determined through literature review and expert advice, and the exercise motions were composed of those for flexibility and muscle strengthening. The participants were instructed to perform the exercise for 15 to 20 minutes each time, twice a day, four times a week. Data were collected by measuring all variables before and after 8 weeks of the exercise intervention. The statistics were analyzed using independent *t* tests, χ^2 tests, Fisher's exact tests, repeated measures analysis of variance, and paired *t* tests.

Both age groups showed differences in pain, muscle strength, disability, and QOL before and after the exercise intervention. The older group showed larger effects in terms of QOL. The results indicated that the exercise intervention had the same effects on both the middle-aged and older groups. Based on the higher QOL improvement in the older than in the middle-aged group, we conclude that exercise management is effective for older adults. In the psychological and social subareas of QOL, the older group showed large effect sizes of 1.16 and 0.83 points, respectively, whereas the effect sizes were small in the middle-aged group. Providing opportunities for nursing management using the Web will not only be effective but also promote the development of nursing information technology.

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