



Original article

Assessment of the efficacy and safety of a Judo exercise program in improving the quality of life among elderly patients

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Abstract

Objectives: Several reports have shown that Tai Chi Chuan can be an effective way to prevent falls among the elderly. However, an exercise program that can prevent injury during falls has not been reported previously. The judo technique called ukemi is used to prevent injuries. To evaluate whether a judo-based exercise program could prevent falls in the elderly, we had the participants practice ukemi as part of a therapeutic routine. The purpose of this study was to examine the clinical significance of the program and to predict its safety.

Methods: From July 2016 to March 2017, we examined 53 individuals who participated in the exercise program. The individuals were divided into high (n=39) and low (n=14) movement ability groups (HMA and LMA groups, respectively), and their physical and psychological functions were evaluated using scores from the Short-Form Health Survey 36. We also collected and analyzed data from questionnaires obtained from 384 patients who participated in the program from July 2016 to July 2019.

Results: The HMA group showed a significant increase in the mental component summary scores before and after the exercise program. In the LMA group, physical functioning, social functioning, and physical component summary scores were significantly improved. Of the participants surveyed, 94.8% had a high level of satisfaction, and 93.2% began accepting the exercise as a daily habit. No adverse events were observed during these exercises.

Conclusion: This novel exercise program was performed safely, and positive effects were observed, especially in individuals with a low quality of life.

Key words: exercise, fall, injury prevention, Judo, quality of life, Ukemi

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Introduction

A large portion of medical costs in Japan is related to the care of the elderly. Exercise is a low-cost option for prevent-

ing diseases and improving everyday life^{1,2}. It is expected to play an important role in reducing medical costs incurred by the elderly^{3,4}.

Habitual exercise has been reported to improve health by preventing disease and dysfunction in healthy subjects⁵. Muscular workouts are expected to improve the physical strength of patients. Reports have described many significant benefits derived from practicing Tai Chi Chuan, a well-known exercise^{6,7}. In addition, strength training in exercise programs is known to have positive health effects^{8,9}.

Judo is a common form of martial arts practiced in many countries. Before practicing throwing techniques or engaging in matches, judo founder Jigoro Kano pointed out that it is imperative to master a technique called ukemi to prevent

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the damaging effects of falls¹⁰.

Ukemi is practiced to prevent injury and minimize pain when a contestant falls or is thrown by an opponent in judo¹⁰. Particularly, it prevents trauma to the head^{11, 12}. In addition to being a basic component of throwing techniques, fall-breaking is also a fundamental part of all judo techniques and is therefore of the highest importance. To the best of our knowledge, there have been no reports regarding the practice of judo and ukemi in exercise programs designed for the elderly.

This study examined the utility of an exercise program called Yawarachan, which incorporates ukemi movements, aimed at preventing falls and fall-related accidents among the elderly. We also determined whether our novel exercise program improved the quality of life of the participants and whether the program could help develop an exercise habit.

Methods

This study was approved by our hospital's institutional review board and was conducted in accordance with the principles of the Declaration of Helsinki for Human Research. We recruited participants for evaluation using Performance Status 0-1 from the hospital where the authors worked.

Written informed consent was obtained from all participants before they were asked to perform any exercise. Prospective participants were subsequently evaluated using a basic physical function test (Performance Status 0-1). We started monthly exercises in July 2016, which ended in March 2020. In this study, 53 participants were taught the Yawarachan exercise and were observed between July 2016 and March 2017 (Table 1).

We were able to obtain responses to questionnaires from 384 individuals who participated in the exercise program. In particular, we recommended that the participants perform the Yawarachan exercise twice a week or more by themselves, and we asked them to answer a questionnaire survey. The questionnaire was divided into five phases.

The performance of a participant was classified as follows: Score 1, if no exercise was performed at all; Score 2, if exercise was performed once in 2 weeks; Score 3, if a

participant performed gymnastics once a week; Score 4, if a participant performed gymnastics twice a week; and Score 5, if a participant performed gymnastics more than three times a week.

Further, we evaluated each participant's health using the Japanese version of the Short-Form Health Survey 36 Version 2 (SF36 Ver2) questionnaire on the days they exercised. SF36 Ver2 scores were used to divide the participants into groups, with those scoring 23 points or less classified into the low movement ability group (LMA) and those scoring 24 points or more into the high movement ability group (HMA)^{13, 15}. The questionnaire had a maximum score of 30. People aged 50 years or above averaged 24.2% in the SF36 Ver2, according to the Japanese population statistics in 2007¹⁶. Each group performed the same exercise program. Participants performed the exercise program with a tatami mat at the Judo Dojo.

Interventions

The basics of the judo involve ground techniques to add muscular strength, ukemi for injury prevention when breaking falls, and body balance with the throwing techniques of Nage-Waza (Figure 1).

Participants were asked to exercise once a month at the Judo Dojo for 1 hour (Figure 2). The important techniques of ukemi include back-break fall (Usiro ukemi) and side break fall (Yoko ukemi). We divided the basic movements of ukemi into cradle motion and Utite, which refers to the motion of the hand hitting the mat.

In the cradle motion, the participants formed a crouching posture with their whole body and then rolled around. This rolling exercise decreases the shock on the body when falling; it prevents the person from bending the neck and hitting the head (Figure 3). In Utite, a hand is stretched straight out so that the patient hits the mat with the palm and the forearm uniformly (Figure 4), dispersing the force when the individual falls. It prevents the fingers and wrist from breaking and the elbow from spraining by cushioning the fall with the hand.

In back Utite, the hand hits the mat, and the neck is simultaneously lifted as one lies down on the back. The hand is angled 45° away from the side of the body. In side Utite,

Table 1 Patient background

n	53
Age*	71 (45–83)
Male / Female (%)	7 (13.2%) / 46 (86.8%)
High movement ability group (HMA)	39 (73.6%)
Low movement ability group (LMA)	14 (26.4%)
The number of participants per exercise*	23 (16–120)
The number of times each participants*	3.2 (1–6)

*Median (range).

Exercise program menu		
Exercise	Concept	Judo technique
Ukemi	injury prevention	Back Uchite
		Side Uchite
		Cradle motion
Ground technique	muscular strength	Back bridge
		Reverse bicycle kick
		Side bicycle kick
Nage-Waza	muscular & balance training	Seoi-nage
		Ashi-barai
		Uchi-mata

Figure 1 Exercise program menu.

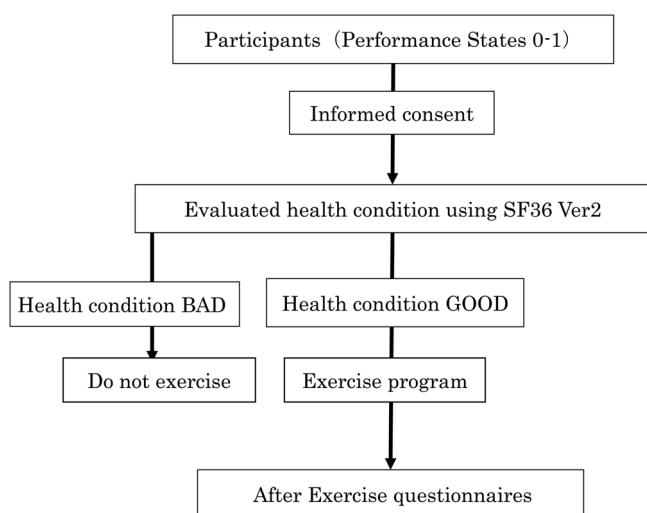


Figure 2 Flow chart of the study.

the neck is lifted while the body rolls onto a sideways position as the hand hits the mat. Participants were asked to turn left when using the left hand or right when using the right hand during the exercise.

The basic exercise of the ground technique involved a back bridge and a reverse side bicycle kick.

The throwing techniques of Nage-Waza involved the motions of Seoi-nage, Ashi-Barai, and Uchi-mata. The Seoi-nage involves “Tai-sabaki” in judo, a pivot motion that turns the direction of the body against a posture and expressed movement. A squat was mixed into the pivot motion, which was carried out as a coordinated motion (Figure 5). The Uchi-mata is similar to a single-leg deadlift - the hand is placed on a wall for assistance in balancing. The Ashi-barai is similar to the side-leg swing - a one-leg balance exercise using a wall for support.

Measurement

The quality of life of the participants was assessed using the Japanese version of the SF36 Ver2^{13, 14}. It contains 36



Figure 3 Cradle motion: The body is curled up and the neck is bent forward as if looking at the navel to prevent the patient’s head from hitting the floor.

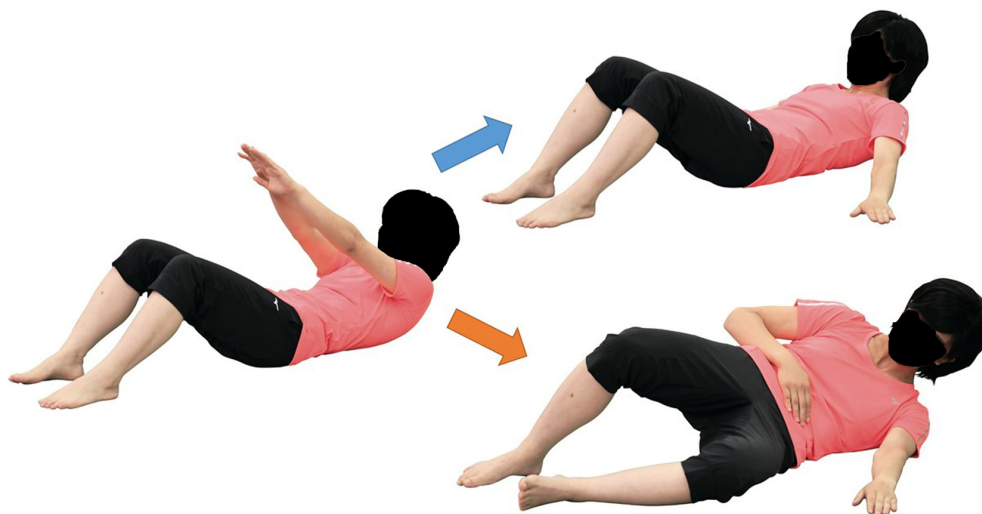


Figure 4 Utite: In this exercise, the head is lifted so that the patient looks at the navel. The hand hits the mat to position the body flat or sideways.

statements grouped into eight subscales: physical functioning (PF), role physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional (RE), and mental health (MH). The range of scores is between 0 and 100 for every subscale; higher scores indicate better health.

The Japanese version includes three other scores for evaluation: physical component summary (PCS), mental component summary (MCS), and role component summary (RCS).

Statistical analysis

The associations between the HMA and LMA groups were evaluated using Pearson's χ^2 test. All calculated *P*-values were two-sided, and statistical significance was set at *P*<0.05. All statistical analyses were performed using the JMP 13 software (SAS Institute, Cary, NC, USA).

Results

Table 1 summarizes the characteristics of the 53 participants. The median age was 71 years (range 45–83 years); there were more females (86.8%) than males (13.2%). The average number of times participants performed the exercises was 3.2 during the 9 months of observation. There were more HMA patients (73.6%) than LMA patients (26.4%). The overall recovery rate of the questionnaires was 85%.

Table 2 shows the differences between the HMA and LMA patients' data during the initial evaluation. The LMA group had significantly lower scores than the HMA group, and scores below the Japanese normal values in PF, RP, BP, SF, and RE (*P*<0.01). Table 2 also shows that the LMA group had significantly lower PCS and RCS scores (*P*<0.01) but significantly higher MCS scores (*P*=0.02) than the HMA group and Japanese normal values.

Table 3 shows that the LMA group had a significant increase in PF (56.7 ± 15.8 : 76.9 ± 16.7) and SF (68.1 ± 23.5 : 82.8 ± 32.0) (*P*<0.05) scores after performing the exercises



Figure 5 This exercise incorporates a pivot motion in Seoi-nage. The body turns 180 degrees and ends in a squat.

Table 2 Results: 1st Initial evaluation (SF36 V2)

n=53	LMA (n=14)	HMA (n=39)	Japanese normal value	<i>P</i>
Age*	72 (62–83)	70 (45–81)	–	0.18
Physical functioning (PF)**	52.5 ± 17.7	91.9 ± 5.2	82.9 ± 7.5	<0.01***
Role physical (RP)**	59.4 ± 23.5	91.9 ± 10.8	85.5 ± 6.8	<0.01***
Body pain (BP)**	49.2 ± 22.2	75.2 ± 20.4	71.2 ± 4.5	<0.01***
General health (GH)**	58.4 ± 23.9	63.8 ± 14.3	60.2 ± 1.6	0.33
Vitality (VT)**	58.0 ± 16.7	67.6 ± 17.2	65.5 ± 1.3	0.07
Social functioning (SF)**	67.9 ± 21.2	87.1 ± 17.5	85.8 ± 2.8	<0.01***
Role emotional (RE)**	65.5 ± 21.6	89.6 ± 15.7	86.3 ± 6.3	<0.01***
Mental health (MH)**	71.8 ± 21.1	70.6 ± 19.0	73.6 ± 1.5	0.84
Physical component summary (PCS)**	28.2 ± 10.6	51.8 ± 6.5	45.3 ± 4.1	<0.01***
Mental component summary (MCS)**	57.3 ± 9.6	50.2 ± 9.4	52.0 ± 1.7	0.02***
Role component summary (RCS)**	39.2 ± 11.6	50.3 ± 7.6	50.0 ± 2.6	<0.01***

*Median (range), **Average (SD), ****P*-value <0.05.

three times or more. PCS scores in the LMA group were also significantly increased ($P < 0.05$). Table 4 shows that only the MCS scores were significantly increased in the HMA group after three or more exercise sessions ($P = 0.02$).

Three lumbago (0.8%) and three meralgia (0.8%) cases were reported as adverse events in the questionnaires. However, none of the patients required hospitalization or treatment. Of the 384 participants who answered the survey, 93.2% reported using the exercise program as part of their daily routine, and 94.8% had a high level of satisfaction with Yawarachan (Table 5).

Discussion

This study examined the safety of phase 1 clinical study and the clinical significance of the Yawarachan exercise that we developed based on judo techniques.

There was no significant difference between the average ages of the LMA and HMA groups; however, the scores of the HMA group were superior to those of the LMA group before the exercises, except for GH, VT, and MH ($P > 0.05$). The HMA group's values were similar to normal Japanese values.

Table 3 Results of the low movement ability group

n=14	Pre-program	≥3 times	P-value
Physical functioning (PF)*	56.7 ± 15.8	76.9 ± 16.7	0.01**
Role physical (RP)*	61.8 ± 24.3	77.3 ± 23.6	0.17
Body pain (BP)*	56.8 ± 23.5	65.3 ± 17.3	0.38
General health (GH)*	69.3 ± 19.9	77.0 ± 18.3	0.44
Vitality (VT)*	62.5 ± 16.5	63.3 ± 23.0	0.75
Social functioning (SF)*	68.1 ± 23.5	82.8 ± 32.0	0.04**
Role emotional (RE)*	70.4 ± 22.1	77.1 ± 23.9	0.52
Mental health (MH)*	78.9 ± 17.8	75.6 ± 28.0	0.76
Physical component summary (PCS)*	32.1 ± 9.3	44.5 ± 11.7	0.018**
Mental component summary (MCS)*	61.2 ± 8.7	57.3 ± 13.2	0.44
Role component summary (RCS)*	37.8 ± 12.2	42.3 ± 16.1	0.49

*Average (SD), **P-value <0.05.

Table 4 Results of the high movement ability group

n=39	Pre-program	≥3 times	P-value
Physical functioning (PF)*	91.8 ± 5.4	88.6 ± 12.2	0.056
Role physical (RP)*	92.4 ± 10.9	85.6 ± 16.6	0.077
Body pain (BP)*	77.5 ± 20.9	67.0 ± 21.1	0.074
General health (GH)*	65.9 ± 15.3	69.67 ± 15.9	0.39
Vitality (VT)*	67.6 ± 18.9	74.5 ± 15.4	0.15
Social functioning (SF)*	88.9 ± 17.5	89.0 ± 16.6	0.97
Role emotional (RE)*	86.3 ± 13.5	86.8 ± 15.5	0.15
Mental health (MH)*	74.0 ± 18.8	83.8 ± 15.9	0.075
Physical component summary (PCS)*	51.4 ± 6.7	48.5 ± 9.2	0.08
Mental component summary (MCS)*	51.6 ± 10.0	56.6 ± 8.4	0.02**
Role component summary (RCS)*	51.4 ± 6.6	48.7 ± 9.1	0.22

*Average (SD), **P-value <0.05.

Table 5 Questionnaire results (2016–2019)

n=384	
Continuation of the exercise habit* Present / Absent	358 (93.2%) / 26 (6.8%)
Satisfaction of exercises*	364 (94.8%) / 20 (5.2%)
Complication present / absent	0 (%) / 384 (100%)
Symptom present / absent	6 (1.6%) / 378 (98.4%)
Details of the symptoms**	Lumbago (3) Thigh ache (3)

*Four or more existed in five phases of evaluations of each question. **There is no treatment and improvement.

PCS and RCS scores were significantly higher in the HMA group than in the LMA group ($P<0.05$). There were no significant differences in the mental elements. Our results also showed that low confidence in body function motivated patients to participate in the exercise program.

Participants in the LMA group showed significantly increased PF, SF, and PCS scores after participating in the exercise program more than three times ($P<0.05$). Our results show that participants communicated during exercises, increasing their physical and social scores. However, there was no significant difference in almost all the scores of the HMA group after more than three exercise sessions. This suggests that that Yawarachan may be a relatively light exercise for an ordinary person.

Our results show that Yawarachan developed into a habit among most participants, with high satisfaction. No injuries were reported in the questionnaire. The majority of the participants (93.2%) were classified as Score 4 or Score 5 and answered 'present' for the 'continuation of the exercise habit', as shown in Table 5.

The participants also acquired the habit of exercising at home, and the effect of the exercises could be seen.

Our results also show that the participants could easily learn the Yawarachan exercises and perform them safely.

Many exercises are designed to prevent falls, and there is substantial evidence that Tai Chi Chuan can help do so. Some studies have reported the effective implementation of the Tai Chi Chuan exercise and evidence-based fall prevention programs that can be implemented in community settings to improve physical fitness and reduce fall risk among older adults^{17–20}. Although Tai Chi Chuan reportedly focuses on training the lower part of the body for fall prevention, the literature suggests that it is better to improve overall movement²⁰. Our study demonstrates that judo-based Yawarachan exercises improved motor function only in participants with low motor function.

In addition, fall prevention helps lower the cost of medi-

cal care among the elderly^{3,21}. Tai Chi Chuan is cost effective because it lowers medical costs by preventing falls¹. Therefore, we propose that the Yawarachan exercise will achieve similar outcomes by preventing injuries during falls.

Ukemi is a technique that reduces shock when the body is thrown and therefore prevents injury. This is the first technique that a judo player learns. The ukemi movement is useful in daily life. To prevent injuries when falling, patients roll using the Mae (forward) or Usiro (back) ukemi techniques. In addition, the Nage-Waza and ground technique exercises in judo are good for overall movement, as they can train the trunk and improve balance and posture.

We believe that our exercises prevented not only falls in elderly people but also injury when they did fall. We also believe that the safety of exercise and quality of life improvements were proven by the responses to the SF36 Ver2 questionnaires.

The main limitation of this study was that we did not evaluate the effects on fall prevention. We were unable to conduct a randomized clinical trial because we tested the safety of this exercise before this study was conducted, and we believe that such a trial should be performed to better evaluate the effect of the exercise program in the future.

Conclusion

We developed an original exercise program called Yawarachan that could be safely performed by elderly participants. This program positively impacted their quality of life, especially for individuals whose quality of life was low.

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