Received: 16 December 2023 | Revised: 22 January 2024 | Accepted: 28 January 2024
DOI: 10.48309/JMPCR.2024.436104.1093

Journal of Medicinal and Pharmaceutical Chemistry Research SAMI

FULL PAPER

Effect of adding Vivifrail©multicomponent exercise to conventional exercise on walking speed and quality of life of elderly with frailty syndrome at Surabaya nursing home

Idia Mawadda[a,*] |Nuniek Nugraheni[b] |Martha Kurnia Kusumawardani[b] |Soenarnatalina Melaniani[c]

[a]*Resident of Departement of Physical Medicine and Rehabilitation, Faculty of Medicine, Airlangga University, Surabaya, Indonesia*

[b]*Departement of Physical Medicine and Rehabilitation, Faculty of Medicine, Airlangga University, Surabaya, Indonesia*

[c]*Department of Public Health and Preventive Medicine, Faculty of Medicine, Airlangga University, Surabaya, Indonesia*

As the elderly population worldwide increases, frailty syndrome becomes a problem that needs attention because it causes health issues and unwanted clinical outcomes, physical limitations, disability, and poor quality of life. Vivifrail is a multi-component exercise program that has become an international reference for preventing frailty and falls in the elderly. This study aims to determined the effect of adding multicomponent exercise to conventional exercise on walking speed and quality of life elderly with frailty syndrome. Twenty-six elderly in the intervention group received Vivifrail exercises 5 times weekly for 4 weeks. Participants in both groups were required to take part in conventional exercises 5-7x/week for ±15 minutes. Walking speed as measured using the 6-meters walking speed test (6mWS) and quality of life using the EQ-5D and EQ-VAS questionnaire at baseline (pre-test) and after 4 weeks of intervention (post-test). There was a significant increase in the 6mWS score (p=0.003), a decrease in the EQ-5D score (p=0.039), and an increase in the EQ-VAS score (p=0.011) in the intervention group. In the control group, there was no significant change in either 6mWS (p=0.402), EQ-5D (p=0.705), or EQ-VAS (p=0.495). There was a significant difference in the 6mWS value between groups after 4 weeks of treatment with p-value of 0.003 and an effect size of 1.304. EQ-5D and EQ-VAS also showed significant differences with p-values of 0.004 and 0.002, respectively. Effect sizes of 0.57 and 0.59 indicated that the difference between the groups was included in the moderate category. The addition of Vivifrail multicomponent exercise to conventional exercise in the elderly with frailty syndrome provides changes in the form of increased walking speed and quality of life as measured using 6mWS, EQ-5D, and EQ-VAS.

***Corresponding Author:**
Idia Mawadda
Email: idiamawadda@gmail.com
Tel.: +62 817-327-414

KEYWORDS

Elderly; EQ-5D; Frailty; multicomponent exercise; quality of life; Vivifrail; walking speed.

Introduction

Aging is a natural process. Everyone will go through this phase of life according to their individual circumstances. According to the World Health Organization (WHO), aging is the course of biological reality that begins at conception and ends with death. The term

"Elderly" is applied to individuals aged 60 years and above, who represent the fastest growing segment of the population worldwide [1].

Globally, there were 727 million people aged 65 years or older in 2020. The number is projected to double to 1.5 billion by 2050. Over the past fifty years, the percentage of the elderly population in Indonesia has increased from 4.5 percent in 1971 to around 10.7 percent in 2020. This figure is projected to continue to increase until it reaches 19.9 percent in 2045 [2].

In the elderly, there are various physiological changes in the body, including nervous, cardiorespiratory, musculoskeletal, digestive, and immune systems. All of these changes can cause a decrease in physical activity and increase the occurrence of frailty syndrome [3].

Frailty is conceptually defined as a clinically recognizable state in older adults with increased vulnerability (frail), resulting from age-related declines in physiological reserves and function across multiple organ systems, resulting in compromised ability to cope with daily stressors [4]. Frailty syndrome results in health issues and undesirable clinical outcomes such as physical limitations and disability, poor quality of life, increased risk of falls, hospitalizations, morbidity, mortality, and health care costs [5,6].

Using a frailty syndrome assessment instrument, an estimated 15% of non-institutionalized adults in the United States are frail, and global estimates of frailty syndrome range from 3.5% to 27.3% [6]. In Indonesia, a cross-sectional study of 235 older adults 60 years and older in four villages in Bali showed that frailty was experienced by 58.9% of women and 41.02% of men [5].

The mechanisms underlying frailty syndrome are multifactorial with inflammatory, nutritional, vascular, and metabolic factors possibly involved. Fried *et al.* defined five criteria of the frailty phenotype as weight loss, fatigue, low grip strength, slow walking speed, and low physical activity. The presence of three or more criteria is defined as frailty, 1-2 criteria are defined as pre-frail Frailty syndrome is a major medical condition in the elderly population as it is a determinant of quality of life and longevity [7].

Walking speed, in addition to being used as one of the criteria for frailty phenotypes, is also a reliable, valid, sensitive, and specific measurement tool, correlated with functional ability, and balance. Walking speed has the potential to predict future health status and functional decline, including hospitalization, discharge location, and mortality [7,8].

Among other complications, older adults with frailty syndrome suffer from frailty due to musculoskeletal disorders (e.g., sarcopenia) that increase polypharmacy and hospitalizations, severely limit daily activities, and drastically reduce their quality of life [9]

Participation in physical activity promotes healthy aging and plays an important role in improving quality of life (QoL) in older adults. Several instruments have been developed to assess health-related quality of life (HRQoL) in different populations. Factors related to demographic and clinical characteristics including age, health status, culture, and language of the population under study are important determinants for using valid HRQoL measures that are relevant and reliable [10]

The EQ-5D is one of the instruments for measuring HRQoL. The EQ-5D is a standardized, non-disease specific instrument, developed to describe and assess HRQoL. It has been translated into most languages, including Indonesian [10].

Exercise programs are aimed at the prevention of functional and cognitive decline during the aging process. In the last decade, studies exploring the benefits of exercise programs when frailty is identified at an early stage have mainly focused on community-dwelling older adults. When compared between intervention and control groups, physical exercise programs have been shown to improve frailty status and enhance cognition, emotional, and social networks in controlled populations of community-dwelling older adults [11]. There is no consensus for the "optimal" exercise modality or frequency for geriatric patients. Most evidence suggests that multicomponent programs that include aerobic, resistance, balance, and flexibility exercises are preferred [3].

The Vivifrail© program is a program developed in Europe by Erasmus. The Vivifrail© multicomponent exercise intervention program consists of resistance training, gait retraining, and balance training. The program offers guidelines for designing a multicomponent physical exercise program for the treatment and prevention of frailty and falls among people older than 70 years of age [12].

The program is tailored to each individual, depending on the elder's level of functional capacity and fall risk. Vivifrail© works on the following components of physical fitness: arm and leg strength, balance and coordination to prevent falls, flexibility, and cardiovascular endurance [12]. Furthermore, the Vivifrail App allows individual monitoring and provides clear instructions to effectively complete the program in a daily environment [9].

Vivifrail multicomponent exercise performed on a population of women with dementia for 12 weeks showed significant results in increasing walking speed and decreasing fall risk [13]. Research conducted by Buendía-Romero *et al.* and Courel-Ibáñez *et al.* showed that the Vivifrail individualized multicomponent exercise program in a short period (4 weeks) has been shown to significantly reverse frailty status, improve functional capacity, and strength parameters in elderly people living in nursing homes [9,14].

No research on the effect of adding Vivifrail© exercise on walking speed and quality of life of the elderly in Indonesia has been published. This study aims to determine the effect of adding Vivifrail© multicomponent exercises to conventional exercises for 4 weeks on walking speed and quality of life of elderly people with frailty syndrome at Griya Werdha Surabaya.

Method

Subjects

Ethical review approval was provided by the Ethical Committee of Soetomo General Academic Hospital Surabaya with number 222/EC/KEPK/FKUA/2022. The subject of this study is elderly people aged > 60 years with frailty syndrome who meet the inclusion criteria and do not meet the exclusion criteria who live in nursing home at Griya Wredha Jambangan, Ketintang Madya St. VI No. 15a Jambangan Surabaya.

Inclusion Criteria: 1) Elderly aged ≥ 60 years; 2) have at least 1 of 5 SF phenotypes according to the criteria of Fried et al (2021) [6]; 3) subjectable to ambulate independently with or without a walking aid with a Barthel Index ≥60; 4) good vision and hearing function; 5) there is no decline in cognitive function so that subjects can understand and follow instructions well (MoCa-Ina score≥26); 6) stable hemodynamics; and 7) subjects are willing to take part in the research program by filling out an informed consent form.

Exclusion criteria included having factors that impeded the performance of the physical exercise program and testing procedures as prescribed by the physician. These factors refer to the Vivifrail program implementation guidelines [1]:

1) Suffering from cardiorespiratory disease that affects physical performance during exercise (NYHA class 3-4 heart failure, COPD, acute heart attack, unstable angina, uncontrolled arrhythmia, aneurysm, severe aortic stenosis, acute endocarditis/pericarditis, and acute or severe respiratory failure); 2) blood pressure (>180/100 mmHg); 3) uncontrolled postural

hypotension; 4) acute thromboembolism; 5) have a history of fracture in the last 3 months or more than 3 months but not union as proven by X-Ray; 6) suffering from an infectious disease that can affect the general condition and implementation of training; 7) have other conditions that cause moderate to severe functional limitations (Barthel index <60); 8) suffering from muscle pain and lower limb joint pain with WBFS (Wong Baker Face Scale) ≥ 4 and clinical signs of swelling, redness and warmth to the touch; 9) chronic diseases that interfere with the mobility function of the elderly (ambulatory disorders due to stroke, uncontrolled diabetes, and balance disorders due to intracranial and extracranial processes such as BPPV and other neurological disorders that can disrupt balance); and 10) have received special physical training using methods other than the routine program at a nursing home in the last 3 months.

Drop out Criteria: 1) The subject withdraws; 2) the subject is not present for two consecutive meetings; 3) attendance is less than 90% of the total attendance attended; 4) the subject is sick, so he has to stop the exercise program; and 5) died.

This study used an experimental method with proportional random sampling and a pre and post-test design study. Elderly subjects who have met the screening inclusion and exclusion criteria are then assessed for SPPB and fall risk assessment according to the Vivifrail protocol from Izquierdo [15]. Subjects were given an explanation of the purpose and benefits of the study and the examination procedure, if the subject was willing, and then the subject was asked to sign a consent sheet to become a study subject and had the right to resign and fill out a resignation sheet.

Data collection on subject characteristics, subjective examination (anamnesis), and physical examination as well as other examinations needed to determine the inclusion and exclusion criteria were carried out by the researcher 1 week before the research intervention was carried out. Measurement of walking speed and initial quality of life will be carried out in both groups and all data are recorded on the data collection sheet.

Study subjects in the treatment group were asked to follow Vivifrail Exercise according to the exercise category allocated based on the SPPB results and fall risk assessment. There will be one introductory session to condition participants for the exercise intervention and to provide guidance for patients to become more familiar with the movements that will be performed during the Vivifrail exercise before the intervention exercise session is implemented. At this session, participants will also be provided with information in the form of a short video and guidance sheet and given the opportunity to consult about the Vivifrail exercise program and the research series.

Participants in both groups are required to follow conventional exercises programmed by Griya Werdha in the form of a combination of light intensity aerobic activities and physical stretching 5-7x/week for 10-15 minutes which are divided into components of 5 minutes of warm-up, 5 minutes of core, and 5 minutes of cooling. Participants' attendance will be recorded and the implementation of this conventional exercise fully follows the existing exercise protocol at Griya Werdha Jambangan.

In the intervention group, the intervention exercise session program will be conducted 5 times per week for 4 weeks according to the daily exercise menu in the programmed Vivifrail passport. For the safety of the subjects and proper implementation of the exercises, the exercises will be supervised by 2 doctors and 4 volunteers.

The final measurement of walking speed and quality of life in both groups will be carried out in a maximum of 1 week after the subject completes the last exercise. The collected data will then be analyzed in accordance with the research objectives.

Statistical analysis

The data obtained will be inputted and processed with the SPSS 26.0 for Windows™ program. Descriptive data presentation is done to determine the characteristics of all data. Data normality test using Saphiro-wilk test. If the data is normally distributed, parametric statistical tests are carried out.

To test the comparison between before treatment and after treatment in each group using the paired t-test if the data is normally distributed, if the data is not normally distributed then use the Wilcoxon rank sign test. After that, to compare the difference between the treatment group and the control group, use the unpaired t test if the data is normally distributed, if the data is not normally distributed, use the Wilcoxon-Mann-Whitney test. The p-value is considered significant if p<0.05.

Results

The characteristics of the study subjects, as well as normality and homogeneity data on the characteristics of the subjects in the intervention group and the control group, are shown in Tables 1-4. Paired sample t-test results 6mWS are presented in Tables 5 and 6, Wilcoxon EQ-5D, and EQ-VAS test are provided in Tables 7 and 8, independent sample t-test results are summarized in Tables 9 and 10, Mann-Whitney test results EQ-5D, and EQ-VAS are indicated in Tables 11 and 12. Pre-test and post-test 6mWS values in the intervention and control groups are displayed in Figure 1, pre-test and post-test EQ-5D scores in intervention and control groups are depicted in Figure 2, and pre-test and post-test EQ-VAS scores in the intervention and control groups are shown in Figure 3.

TABLE 1 Subject characteristics of the study

Characteristics	Group	N (people)	Min	Max	Mean	Std. Deviation	Normality p- value#
Age (years)	**Intervention**	13	61	95	76.69	9.37	
	60-70	(3) 23.1%					
	71-80	(6) 46.1%					
	>80	(4) 30.8%					
	Control	13	60	94	76.31	9.48	
	60-70	(3) 23.1%					
	71-80	(6) 46.1%					
	>80	(4) 30.8%					
Gender	**Intervention**	13					
	Men	(5) 38.5%					
	Women	(8) 61.5%					
	Control	13					
	Men	(5) 38.5%					
	Women	(8) 61.5%					
Education	**Intervention**	13					
	Not attending School	(2) 15.4%					
	Elementary school	(6) 46.2%					
	Junior High School	(1) 7.7%					
	Senior High school	(2) 15.4%					
	College	(2) 15.4%					

	Control	13					
	Not attending School	(5) 38.5%					
	Elementary school	(4) 30.8%					
	Junior High School	(2) 15.4%					
	Senior High school	(0) 0%					
	College	(2) 15.4%					
Body weight (kg)	**Intervention**	13	27.8	81.0	53.18	16.73	0.34
	Control	13	31.2	83.7	51.44	14.15	0.57
Height (m)	**Intervention**	13	1.43	1.66	1.53	0.08	0.10
	Control	13	1.35	1.63	1.51	0.08	0.94
BMI (kg/m2)	**Intervention**	13	13.59	36.00	22.44	6.18	0.64
	Control	13	14.42	37.20	22.60	5.85	0.18
Frailty status	**Intervention**						
	Pre-frailty	(8) 61.5%					
	Frailty	(5) 38.5%					
	Control						
	Pre-frailty	(8) 61.5%					
	Frailty	(5) 38.5%					
SPPB Pre	**Intervention**	13	7	12	9.08	1.66	0.34
	Control	13	4	10	7.31	2.02	0.30
SPPB Post	**Intervention**	13	7	12	10.62	1.71	
	Control	13	4	10	7.31	1.97	

TABLE 2 6mWS characteristics (pre – post-test)

6mWS Pre-test	N (people)	Min	Max	Mean	Std. Deviation
Intervention	13	0.4	1.09	0.74	0.20
Control	13	0.32	1.57	0.74	0.33
6mWS Post-test					
Intervention	13	0.4	1.37	0.99	0.26
Control	13	0.4	0.99	0.69	0.21

TABLE 3 Characteristics of EQ-5D (pre -and post-test)

EQ-5D Pre-test	N (people)	Min	Max	Mean	Std. Deviation
Intervention	13	5.00	8.00	5.85	0.99
Control	13	5.00	10.00	6.85	1.57
EQ-5D Post-test					
Intervention	13	5.00	7.00	5.23	0.60
Control	13	5.00	10.00	6.92	1.75

TABLE 4 Characteristics of EQ-VAS (pre- and post-test)

EQ-VAS Pre-test	N (people)	Min	Max	Mean	Std. Deviation
Intervention	13	50.00	100.00	80.69	17.01
Control	13	50.00	99.00	73.38	16.37
EQ-VAS Post-test					
Intervention	13	50.00	100.00	93.31	13.68
Control	13	50.00	100.00	73.08	18.99

TABLE 5 Paired sample t-test results 6mWS Intervention Group

Variables	Group	Min	Max	Mean±SD	Difference	Cohens'd	P-value
6mWS	Pre-Test	0.40	1.09	0.74±0.20	-2.47	-1.013 (Large)	0.003*
	Post-Test	0.40	1.37	0.99±0.26			

*p<0.05 (Significantly different from 5% significant level)

TABLE 6 Paired sample t-test results 6mWS Control Group

Variables	Group	Min	Max	Mean±SD	Difference	Cohens'd	P-value
6mWS	Pre-Test	0.32	1.57	0.74±0.33	0.05	0.241 (Small)	0.402
	Post-Test	0.40	0.99	0.69±0.21			

*p<0.05 (Significantly different from 5% significant level)

TABLE 7 Wilcoxon EQ-5D and EQ-VAS test results Intervention Group

Variables	Group	Min	Max	Mean±SD	Effect Size	P-value
EQ-5D	Pre-Test	5.00	8.00	5.85±0.99	0.40 (Small)	0.039*
	Post-Test	5.00	7.00	5.23±0.60		
EQ-VAS	Pre-Test	50.00	100.00	80.69±17.01	0.50 (Moderate)	0.011*
	Post-Test	50.00	100.00	93.31±13.68		

*p<0.05 (Significantly different from 5% significant level)

TABLE 8 Wilcoxon EQ-5D and EQ-VAS test results Control Group

Variables	Group	Min	Max	Mean±SD	Effect Size	P-value
EQ-5D	Pre-Test	5.00	10.00	6.85±1.57	0.07 (Very Small)	0.705
	Post-Test	5.00	10.00	6.92±1.75		
EQ-VAS	Pre-Test	50.00	99.00	73.38±16.37	0.13 (Very Small)	0.495
	Post-Test	50.00	100.00	73.08 ±18.99		

*p<0.05 (Significantly different from 5% significant level)

TABLE 9 Independent sample t-test results 6mWS (pre-test)

Variables	Group	Min	Max	Mean±SD	Difference	Cohens'd	P-value
6mWS	Intervention	0.40	1.09	0.74±0.20	0.002	0.006 (very small)	0.989
	Control	0.32	1.57	0.74±0.33			

*p<0.05 (Significantly different from 5% significant level)

TABLE 10 Independent sample t-test results 6mWS (post-test)

Variables	Group	Min	Max	Mean±SD	Difference	Cohens' d	P-value
6mWS	Intervention	0.40	1.37	0.99±0.26	0.30	1.304 (Very Large)	0.003*
	Control	0.40	0.99	0.69 ±0.21			

*p<0.05 (Significantly different from 5% significant level)

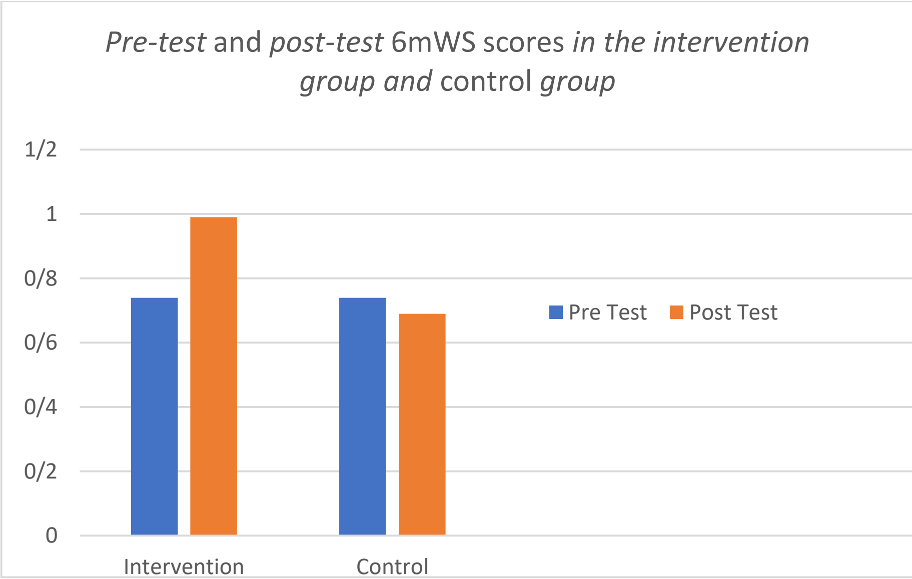

FIGURE 1 Pre-test and post-test 6mWS values in the intervention and control groups

TABLE 11 Mann-Whitney test results EQ-5D and EQ-VAS (pre-test)

Variables	Group	Min	Max	Mean±SD	Effect Size	P-value
EQ-5D	Intervention	5.00	8.00	5.85±0.99	0.34 (small)	0.084
	Control	5.00	10.00	6.85±1.57		
EQ-VAS	Intervention	50.00	100.00	80.69±17.01	0.27 (small)	0.167
	Control	50.00	99.00	73.38±16.37		

*p<0.05 (Significantly different from 5% significant level)

TABLE 12 Mann-Whitney test results EQ-5D and EQ-VAS (post-test)

Variables	Group	Min	Max	Mean±SD	Effect Size	P-value
EQ-5D	Intervention	5.00	7.00	5.23±0.60	0.57 (moderate)	0.004*
	Control	5.00	10.00	6.92±1.75		
EQ-VAS	Intervention	50.00	100.00	93.31 ± 13.68	0.59 (moderate)	0.002*
	Control	50.00	100.00	73.08 ± 18.99		

*p<0.05 (Significantly different from 5% significant level)

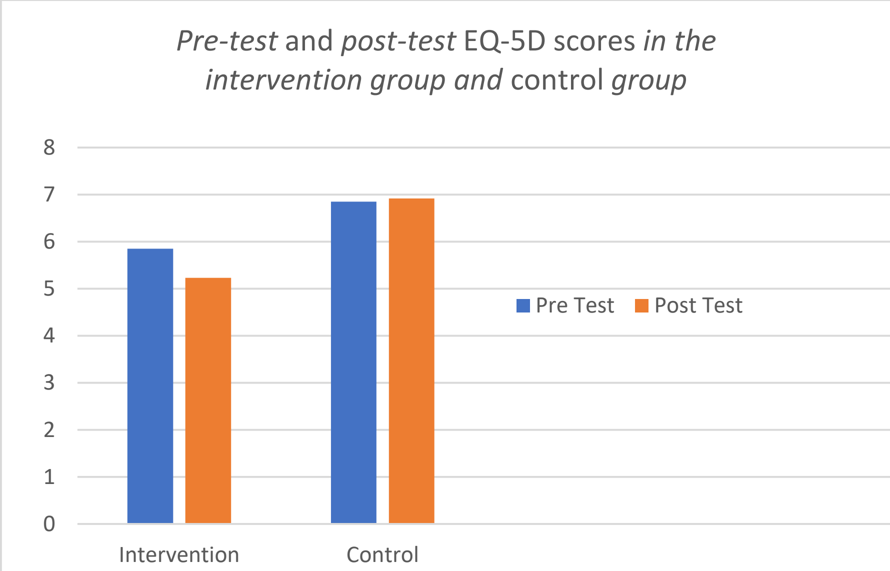

FIGURE 2 Pre-test and post-test EQ-5D scores in intervention and control groups

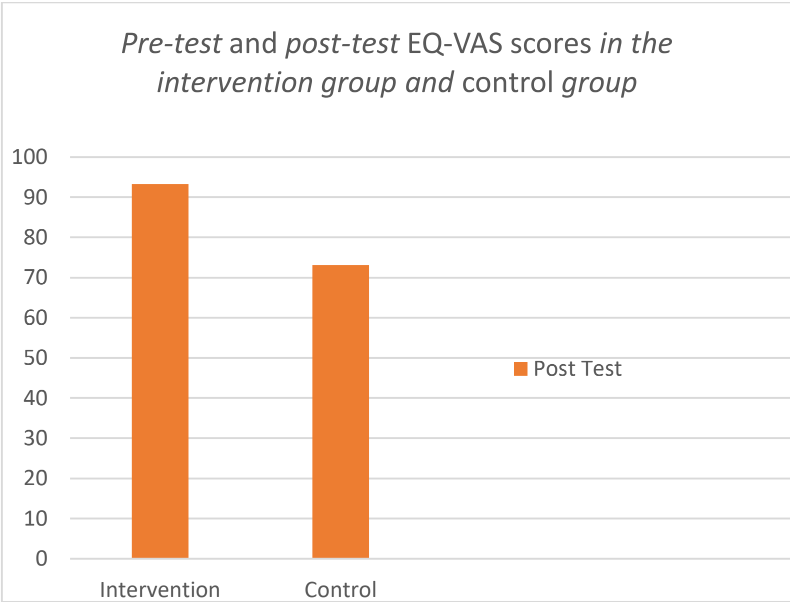

FIGURE 3 Pre-test and post-test EQ-VAS scores in the intervention and control groups

Discussion

This study took male and female subjects >60 years old with frailty syndrome. The gender of the subjects was mostly female at 61.5% and the most frailty status was Pre-frailty at 61.5%. The gender ratio between women and men and the frailty status between prefrailty and frailty in both groups was the same, namely 8:5. This finding is in accordance with a previous study that said women suffered more frailty syndrome than men (7:5) in the Caucasian race, while in the African-American group it was found to be twice that of the Caucasian race (14:7) [16]. In Indonesia itself, a cross-sectional study of 235 elderly people 60 years and over in four villages in Bali showed that frailty was experienced by 58.9% of women and 41.02% of men [5].

In both the intervention and control groups, education levels were more at lower levels such as elementary school or no schooling

(61.6% and 69.3%) than higher levels such as junior high school, high school, and college (38.5% and 30.8%). This is in line with a 13-year longitudinal study in the Netherlands where older adults with low levels of education had significantly higher odds of becoming frail than those with high levels of education (model I, OR 2.94; 95% confidence interval [CI] 1.84-4.71) [17].

Weight, height, and BMI characteristics were assessed in this study because they can affect walking speed in the elderly. It is known that height, weight, and body mass index, affect stance phase [18]. In the elderly themselves, there are changes in walking patterns in the form of decreased stride length, generally increased cycle time (decreased cadence), increased walking base, and a relative increase in the duration of the stance phase [19,20].

The Short Physical Performance Battery (SPPB) test was designed to measure the functional status and physical performance of older adults and has been well validated to assess physical function and to predict disability and all-cause mortality in community-dwelling older adults. A total SPPB score of 8 points or less for men and 7 points or less for women is said to identify frailty status and predict geriatric syndrome in the elderly [21,22]. In this study, SPPB was used at baseline before Vivifrail multicomponent exercise was initiated to determine exercise recommendations based on the level of functional capacity of the elderly along with 6m walking accuracy and fall risk [23,24]. The results of the study revealed that after the treatment, there was an increase in SPPB scores compared to baseline data in the intervention group, while in the control group the score was fixed. This proves that by providing Vivifrail multicomponent exercises can improve the functional status and physical performance of the elderly as measured by SPPB. This finding supports previous research in which SPPB scores and frailty status improved after 4 weeks of Vivifrail multicomponent exercise in elderly people with physical frailty and functional disability living in Spanish nursing homes [9].

The results of this study indicate that there is a positive effect of providing Vivifrail multicomponent training on walking speed assessed using 6mWS in the elderly with frailty syndrome. The intervention group experienced a significant increase in 6mWS after treatment with p=0.003, while the control group did not experience significant changes at the end of the study. The effect size value of 6mWS in the intervention group before and after treatment was -1.013, indicating that the provision of Vivifrail multicomponent exercises had a strong effect on increasing walking speed.

The significant increase in 6mWS values after treatment in the intervention group of this study is in accordance with previous research conducted by Buendía-Romero *et al.* in which the administration of the Vivifrail individualized multicomponent exercise program in a short period of time (4 weeks) has been shown to significantly improve the walking speed of elderly people living in nursing homes [9]. In another study comparing the provision of Vivifrail multicomponent exercise in elderly with sarcopenia in the short term (4 weeks) with the long term (24 weeks), it was found that there was a significant increase in walking speed after treatment in both the short term (P = 0.001) and long term (P = 0.044) [14].

Vivifrail's multicomponent exercise program consists of arm and leg strengthening exercises, balance and coordination to prevent falls, flexibility exercises, and cardiovascular endurance. The implementation was adapted to the existing Vivifrail training passport and protocol [25]. The Vivifrail multicomponent exercise component consists of lower limb exercises (rising to standing from a seated position in a chair, tiptoeing, bilateral knee extension, and leg swing and hold) and upper limb exercises (arm swing and hold, squeezing, and squeezing movements), balance exercises and walking pattern exercises (e.g., semitandem walking, standing on one leg, stepping exercises, walking with small obstacles, shifting weight from 1 leg to the other), and cardiovascular endurance exercises in the form of walking with periodic rest periods [15].

The researcher believes that the increase in walking speed after 4 weeks of treatment is the effect of vascular and neural adaptation and increased cardiovascular endurance. Strengthening exercises lead to an increase in the number of motor units and the quality of NMJ so that muscle recurrence and strength increase. This along with improved balance and coordination control system resulted in increased walking speed. Sit-to-stand and walking movements require coordination, balance, and trigger activity of the thigh flexor muscles and ankle muscles which causes an increase in muscle strength, coordination, and affects the increase in walking speed. In walking training, subjects train speed, distance, direction, rhythm, tone and muscle strength while walking so that there is an increase in coordination ability and body mass transfer through movements in the lower limbs and cause an increase in step length and stride length thereby increasing walking speed and cadence [23-24,26].

In the control group, there was a decrease in average walking speed at the end of the study (4 weeks later) with a delta of 6mWS 0.05 but not statistically significant, p=0.402), this can be related to the theory that the onset of age-related changes in walking patterns occurs in the age decade of 60 to 70 years and progressively decreases or slows down with age [19,20].

Health-related quality of life can be defined as "how well a person functions in their life and perceived well-being in the domains of physical, mental, and social health" [27–29].

Of the various tools to assess quality of life, the EQ-5D is a standardized, non-illness specific instrument developed to describe and assess HRQoL. It has been translated into most languages, including Indonesian and described as a valid and reliable instrument to assess HRQoL in different populations [10,30-31].

The EQ-5D consists of a descriptive system (EQ-5D) and a visual analog scale (EQ-VAS). The descriptive system includes five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) and each dimension includes three coding levels: 1 = no problem; 2 = moderate problem; 3 = severe problem. In addition, respondents report their self-rated health on the EQ-VAS between a range of 100 (best health you can imagine) and 0 (worst health you can imagine) [10].

The results of the study indicated a significant changes when the p value was <0.05. The findings in this study showed that the intervention group experienced a significant improvement in quality of life, characterized by a decrease in the average EQ-5D score (p=0.039) and an increase in the EQ-VAS score (p=0.011), while the control group that only received conventional training did not experience significant changes, EQ-5D p=0.705 and EQ-VAS p=0.495. The effect size value of the EQ-5D of the intervention group between before and after treatment was 0.40 and the effect size value of the EQ-VAS of the intervention group between before and after treatment was 0.50, indicating that the provision of Vivifrail multicomponent training has a small to moderate effect on changes in the quality of life of the elderly with frailty syndrome.

To date, no studies have assessed the effect of short-term (4 weeks) Vivifrail multicomponent exercise on the quality of life of elderly people with frailty syndrome. Generally, the assessment is carried out after 12 weeks of treatment. Research conducted by Petrella et al. in 2021 on 44 elderly people with frailty in a geriatric outpatient clinic in Brazil looked at the effect of 12 weeks of Vivifrail multicomponent exercise, one of which was on quality of life using the EQ-5D, but it was still a protocol study and there were no further published results [25]. The findings in this study are different from research conducted by Casas Herrero et al. from 2017 to 2020 on 188 elderly people with frailty syndrome who have mild to moderate cognitive impairment in a Spanish geriatric outpatient clinic who saw the effect of 12 weeks of Vivifrail multicomponent exercise, one of which was on quality of life assessed using the EQ-VAS. The results of the study said there was no significant difference in quality of life measured using the EQ-VAS after 12 weeks of treatment (p=0.942>0.05) [12,32]. The WHO defines quality of life as an individual's perception of his or her position in life, in the context of the culture and value system in which the individual lives and in relation to goals, expectations, standards, and concerns [33]. Researchers argue that the differences in these findings can be influenced by the different perceptions of individuals in seeing their health conditions, where these perceptions are influenced by various things such as age, education level, culture, etc. However, the study did not explain the level of education in the study. However, the study did not explain the education level of the subjects.

At the beginning of the study, the comparison of the average 6mWS in the intervention group and the control group was not significantly different with a p value of 0.989 and a homogeneity test was carried out which showed that the data was homogeneous before treatment. At the end of the study, it was found that the average 6mWS of the intervention group increased significantly from 0.74±0.20 to 0.99±0.26 (p=0.003) after 4 weeks, while in the control group there was a decrease but not significantly from 0.74±0.33 to 0.69± 0.21 (p=0.402) after 4 weeks. The effect size value of the change in 6mWS between groups was 1.304, indicating a very large effect.

The results of this study are in line with the majority of the literature reviewed in previous systematic reviews. One review that analyzed ten studies on the effects of physical exercise on factors affecting movement in older adults with sarcopenia in the community showed that physical exercise interventions did change the walking speed of individuals with sarcopenia (SMD = 0.42; 95% CI: 0.11 to 0.72). Interpretation showed a moderate effect (0.4 ≤ SMD ≤ 0.7) on walking speed. Among studies that reported gait changes, large effects were found for studies that performed for 12 weeks and significant improvements in walking speed were found for both resistance exercise and multicomponent exercise [34].

According to previous articles, exercises for elderly with pre-frailty and frailty are recommended to be multicomponent consisting of aerobics, strengthening, balance, and flexibility. The difference in exercise prescription for pre-frailty is more strengthening and balance components, while in frailty more aerobic components. The optimal implementation time is 45-60 minutes for pre-frailty and 30-45 minutes for frailty [26].

All of the components mentioned in the above paragraph are covered in the Vivifrail multicomponent exercise program that combines strength, balance, flexibility, and endurance training with walking for the prevention of falls and frailty in older adults, with an exercise time ranging from 30-60 minutes [15]. The conventional exercise protocol only includes aerobic and flexibility components, and the duration is only about 15 minutes. The difference in the components and duration of the two exercise protocols may account for the difference in outcomes between the two groups after 4 weeks. This further strengthens the evidence of the superiority of adding 4 weeks of Vivifrail exercise to conventional exercise on walking speed of older people with frailty syndrome compared to those who received conventional exercise alone.

NavarreteVillanueva et al. showed that there was a relationship between frailty statuses and walking speed, the frailty group had lower speed values than the non-frailty group [35]. A cross sectional study by Wu and

Zhao on the elderly aged 60-80 years in China revealed a moderate positive correlation between the level of functional fitness of the elderly and walking speed. The more the walking speed decreases, the more the functional fitness of the elderly decreases, and vice versa [36]. In line with this study, a cross-sectional study in Bali, Indonesia also states that there is a relationship between walking speed and physical fitness of the elderly with a positive correlation [37]. In the study, it was found that walking speed increased significantly after the addition of multicomponent training to conventional training for 4 weeks for the elderly with frailty syndrome, this also strengthens the superiority of these exercises in improving the fitness of the elderly, especially those with frailty syndrome.

The quality of life in the treatment and control groups at the beginning of the study did not differ significantly, both EQ-5D (p=0.084) and EQ-VAS (p=0.167). At the end of the study, the quality of life of the intervention group improved significantly, characterized by a decrease in the mean EQ-5D score (p=0.039) and an increase in the mean EQ-VAS score (p=0.011), while the results in the control group were relatively stable (EQ-5D p=0.705 and EQ-VAS p=0.495). Comparison of changes between the intervention and control groups after treatment was significant with p=0.004 for EQ-5D and p=0.002 for EQ-VAS. The effect size value of EQ-5D of 0.57 and EQ-VAS of 0.59 shows that the difference in changes in the quality of life of the treatment and control groups is included in the moderate category (moderate) so this indicates that the addition of Vivifrail multicomponent exercises to conventional exercises has a sufficient effect to provide changes in the form of improving the quality of life of the elderly with frailty syndrome.

In assessing quality of life using the EQ-5D questionnaire, there are two scoring systems, the first is the EQ-5D in the form of a descriptive question system that includes the dimensions of mobility, self-care, usual activities, pain / discomfort, and anxiety / depression; and the EQ-VAS is a scale with a range of 0-100 about each assessment of their health conditions where 0 is the worst health condition and 100 is the best health condition [10].

Previous studies suggest that when walking speed slows below 1.0-1.2 m/s it is reported that older people have difficulty crossing the road safely before the traffic lights change. In detail, a decrease in walking speed of 0.1 m/s is associated with a 10% decrease in performing activities of daily living. Elderly people with a walking speed of 0.25 m/s are more likely to be dependent on doing one or more activities of daily living which will reduce the quality of life of the elderly [37].

Vivifrail multicomponent exercise combines upper and lower limb strengthening, balance, flexibility, and cardiorespiratory endurance exercises. Dosage and exercise protocols are also well standardized with rapid screening of the Vivifrail protocol with SPPB and fear of falling, so that older adults receive an exercise program that is appropriate for their functional level [15]. This combination of exercises leads to vascular and neural adaptations and increased cardiovascular endurance. Strengthening exercises lead to an increase in the number of motor units and the quality of NMJs resulting in increased muscle recurrence and strength. This coincides with the improvement of the balance and coordination control system so that walking speed increases [23,24]. With increased strength, it will make it easier for the elderly to move, improved walking speed will help the elderly in mobilization, both of which make it easier to carry out daily activities, including self-care.

The beneficial effects of physical exercise or multicomponent exercise programs on the mental health of elderly people living in nursing homes can be explained by the fact that such programs increase cognitive vitality. Physical exercise or multicomponent exercise programs can cause the release of neurotrophic factors, such as BDNF and insulin growth factor 1, which can cross the blood-brain barrier to induce synaptic plasticity and neurogenesis that improve cognition. In addition, the increased release of BDNF after physical activity may positively affect depressive symptoms. Other secretions such as dopamine and serotonin may also explain the reduction in depressive symptoms and pain after physical exercise. Furthermore, physical exercise or multicomponent exercise programs allow for the establishment of social relationships between the elderly and supervisors as well as between the elderly. This social connection is an important factor that can affect the quality of life of the elderly [38].

The researcher believes that the above reasons can explain the improvement in EQ-5D and EQ-VAS results in this study. The implementation of the treatment which was carried out in a short period (4 weeks) but had a significant effect also added to the advantages of providing additional Vivifrail multicomponent exercises for the elderly with frailty syndrome.

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Conclusion

The conclusion of this study is that the addition of Vivifrail multicomponent exercise to conventional exercise in the elderly with frailty syndrome provides changes in the form of increased walking speed and quality of life as measured using 6mWS, EQ-5D, and EQ-VAS.

Acknowledgements

The authors would like to thank all the staff and participants at Griya Wredha Jambangan Surabaya and Physical Medicine and Rehabilitation Center, Dr. Soetomo General Hospital.

Funding

None.

Authors' Contributions

All authors have made the same contribution in writing the report on the results of this study, from the stage of proposal preparation, data search, and data analysis to the interpretation of research data and presentation of final report.

Conflict of Interest

The authors declare no conflict of interest.

Orcid:

Idia Mawadda:*
https://orcid.org/0009-0005-1163-0088
Nuniek Nugraheni:
https://orcid.org/0000-0002-5629-3047
Martha Kurnia Kusumawardani:
https://orcid.org/0000-0002-3661-0236
Soenarnatalina Melaniani:
https://orcid.org/0000-0002-4449-153X

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How to cite this article: Idia Mawadda*, Nuniek Nugraheni, Martha Kurnia Kusumawardani, Effect of adding Vivifrail©multicomponent exercise to conventional exercise on walking speed and quality of life of elderly with frailty syndrome at Surabaya nursing home. *Journal of Medicinal and Pharmaceutical Chemistry Research*, 2024, 6(7), 823-841. **Link:** https://jmpcr.samipubco.com/article_189525.html