Effects of a Walking Enhancing Program on Self-Efficacy for Walking, Fatigue, and Physical Ability Among Acute Stroke Patients: A Preliminary Analysis*

ผลของโปรแกรมการส่งเสริมการเดินต่อการรับรู้สมรรถนะแห่งตนในการเดิน ความเหนื่อยล้า และความสามารถทางกายภาพ ในผู้ป่วยโรคหลอดเลือดสมองระยะเฉียบพลัน: การวิเคราะห์เบื้องต้น*

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Abstract

Stroke is a common cause of disabilities that require ongoing care. Proper rehabilitation will allow patients to return to help themselves more. The literature review shows that post-stroke fatigue (PSF) is a key factor in post-stroke recovery. This quasi-experimental research used a pretest-posttest with a control group, and aimed to examine the effect of a walking enhancing program (WEP) on self-efficacy for walking, fatigue, and physical abilities among acute stroke patients. The program was developed based on the self-efficacy theory and the brain plasticity theory. Thirty persons with acute stroke admitted to a university hospital in Pathum Thani Province were recruited. The participants were randomly assigned to either an experimental group or a control group by the week of admission. The experimental group received the walking enhancing program in combination with usual care, while the control group received usual care. The research outcomes were measured before starting the program at baseline and at 3 weeks after the experiment. The instruments included the Demographic Questionnaire, the Self-Efficacy for Walking Exercise Scale (SEFWS), the Fatigue Severity Scale (FSS), and the 6-minute walk test (6MWT). Data were analyzed using descriptive statistics and t-test.

The findings demonstrated that the experimental group had significantly higher mean SEFWS and 6MWT scores at 3 weeks comparing to the control group ($t=9.613$, $p<.05$; $t=3.062$, $p<.05$) and compared within the group at baseline ($t=15.094$, $p<.05$; $t=7.539$, $p<.05$). Moreover, the experimental group had significantly lower mean FSS scores than the control group ($t=-8.090$, $p<.05$; $t=-8.353$, $p<.05$) at 3 weeks.

The results show that the WEP may increase self-efficacy for walking exercise, reduce fatigue, and improve physical abilities in acute stroke patients. Nurses and multidisciplinary teams can apply this program in order to reduce fatigue, resulting in effective rehabilitation.

Keywords: Walking enhancing program; Fatigue; Self-efficacy; Physical ability; Acute stroke patients

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บทคัดย่อ

โรคหลอดเลือดสมองเป็นสาเหตุของความพิการที่ต้องการดูแลต่อเนื่อง การฟื้นฟูสภาพที่เหมาะสมจะทำให้ผู้ป่วยสามารถกลับไปช่วยเหลือตนได้มากขึ้น จากการทบทวนวรรณกรรมพบว่าความเหนื่อยล้าเป็นปัจจัยสำคัญต่อการฟื้นตัวหลังการเกิดโรคหลอดเลือดสมอง การศึกษาครั้งนี้เป็นการวิจัยกึ่งทดลองที่มีการทดสอบก่อนและหลังการทดลองและมีกลุ่มควบคุม มีวัตถุประสงค์เพื่อศึกษาผลของโปรแกรมการส่งเสริมการเดินต่อการรับรู้สมรรถนะแห่งตนในการเดิน ความเหนื่อยล้า และความสามารถทางกายภาพในผู้ป่วยโรคหลอดเลือดสมองระยะเฉียบพลัน ซึ่งโปรแกรมนี้พัฒนาขึ้นจากทฤษฎีการรับรู้สมรรถนะแห่งตนร่วมกับทฤษฎีความยืดหยุ่นของสมอง กลุ่มตัวอย่างคือผู้ป่วยโรคหลอดเลือดสมองระยะเฉียบพลัน ที่เข้ารับการรักษาในโรงพยาบาลมหาวิทยาลัย ในจังหวัดปทุมธานี จำนวน 30 ราย ซึ่งแบ่งออกเป็นกลุ่มควบคุม และกลุ่มทดลอง ในสัปดาห์แรกที่เข้ารับการรักษา กลุ่มทดลองได้รับโปรแกรมการส่งเสริมการเดินร่วมกับการดูแลตามปกติ ในขณะที่กลุ่มควบคุมได้รับการดูแลตามปกติ ประเมินผลลัพธ์ก่อนและหลังการทดลองสัปดาห์ที่ 3 เครื่องมือที่ใช้ในการทดลอง ประกอบด้วย แบบบันทึกข้อมูลทั่วไป แบบประเมินการรับรู้สมรรถนะแห่งตนในการเดิน แบบประเมินความเหนื่อยล้า และการทดสอบด้วยการเดิน 6 นาที วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา และสถิติ t-test

ผลการวิจัย พบว่ากลุ่มทดลองมีค่าเฉลี่ยของคะแนนการรับรู้สมรรถนะแห่งตนในการเดิน และความสามารถทางกายภาพมากกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ ($t=9.613$, $p<.05$; $t=3.062$, $p<.05$) และมากกว่าก่อนทดลอง ($t=15.094$, $p<.05$; $t=7.539$, $p<.05$) และกลุ่มทดลองมีค่าเฉลี่ยของคะแนนความเหนื่อยล้าน้อยกว่าก่อนการทดลอง และน้อยกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ($t=-8.090$, $p<.05$; $t=-8.353$, $p<.05$)

ผลการศึกษาครั้งนี้ แสดงให้เห็นว่า โปรแกรมการส่งเสริมการเดินอาจทำให้การรับรู้สมรรถนะแห่งตนในการเดินเพิ่มขึ้น ลดความเหนื่อยล้า และเพิ่มความสามารถทางกายภาพในผู้ป่วยโรคหลอดเลือดสมองในระยะเฉียบพลัน พยาบาลและทีมสหสาขาวิชาชีพสามารถนำไปประยุกต์ใช้เพื่อลดความเหนื่อยล้าเพื่อการฟื้นฟูสภาพหลังการเจ็บป่วยให้มีประสิทธิภาพมากยิ่งขึ้น

คำสำคัญ: โปรแกรมการส่งเสริมการเดิน ความเหนื่อยล้า การรับรู้สมรรถนะแห่งตน ความสามารถทางกายภาพ ผู้ป่วยโรคหลอดเลือดสมอง

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Background and Significance

Stroke is a leading cause of disability worldwide among adults and older adults, and requires ongoing care. The global incidence of strokes has been reported, with a steady increase in new cases while the mortality rate has declined (Avan et al., 2019). As a result, there is an increasing number of stroke patients who are in dependency making the expenses of care up to 1.39-1.88 million baht in the first 2 years of treatment (Lekander et al., 2017). In Thailand, a survey in 2020 revealed that stroke is the third leading cause of death after cancer and pneumonia. The average stroke death rate in Thailand rose to 8.38% in 2021 and the highest percentage (14.87) occurred in the 4th Public Health Region (Strategy and Planning Division Ministry of Public Health, 2021). Stroke survivors are in a dependency state at the rate of 53.3%, and they need care for more than 40 hours per week (Junsiri, 2021). Thammasat University Hospital is a super tertiary hospital that has a Center of Excellence for stroke. In 2020, there were 568 stroke patients receiving services at this center, of which 46.48% of the surviving patients were in a dependency state. Among these patients, fatigue was reported as the most common symptom (Thammasat University Hospital, 2020).

Rehabilitation process is the most important for post-stroke patients to regain as much capability as possible. From the literature review, post stroke fatigue (PSF) was a significant factor impeding recovery both in the acute phase and the rehabilitation phase. PSF is defined as disproportionate mental or physical tiredness and lack of energy activated by simple activities that do not ameliorate with normal rest (Aarnes, Stubberud, & Lerdal, 2020). PSF can occur immediately after a stroke, stroke patients with PSF reported of having fatigue more than 6 hours a day with a frequency of 20 - 30 days per month (Choi-Kwon, Han, Kwon, & Kim, 2005). That is important as it may interfere with early rehabilitation in the golden period time, return to work and daily activities, and may compromise independence. Therefore, early fatigue management programs are very essential for optimizing recovery in post-stroke patients.

Previous studies regarding fatigue management programs were reviewed, and most of these focused on maintaining energy balance by changing behaviors such as sleep, nutrition-taking, or physical activity (Barker-Collo et al., 2022; Clarke, Barker-Collo, & Feigin, 2012; Zedlitz, Rietveld, Geurts, & Fasotti, 2012). The inappropriation of energy balance can lead to an increased perception of intense physical and mental fatigue (Tardy, Pouteau, Marquez, Yilmaz, & Scholey, 2020). The literature review shows that nutrition-taking is the creation of energy for the body by consuming enough water and nutrients to meet bodily needs (Srisawat, Kumpolsiri, & Panuthai, 2021) whereas sleep can help in reserving energy for the body (Joa et al., 2017). In addition, exercise is an essential strategy for recovery in post-stroke patients. Performing physical activities is a way of energy consumption that promotes patients' recovery (Billinger et al., 2014; Billinger, Boyne, Coughenour, Dunning, & Mattlage, 2015).

Exercise is a subset of physical activity, which has the characteristics of an activity pattern, it is planned, and it can be repeated (Harniratisai, 2018). Walking exercise is a qualified exercise

and suitable for stroke patients as it is convenient and safe. Walking, one kind of aerobic exercise, for at least 2 weeks, can increase patients' physical ability (Muangngoen & Saipan, 2019; Saunders et al., 2016). Moreover, performing walking continuously for 4 weeks can improve the quality of life in stroke patients (Klassen et al., 2020). Walking exercise can also reduce fatigue and ultimately promote rehabilitation among stroke patients (Zedlitz et al., 2012).

FITT (frequency, intensity, time, and type) has been acknowledged as the principles for designing walking enhancement programs for stroke patients (Billinger et al., 2015). According to FITT, a walking enhancement program for stroke patients should be composed of the following steps: 1) setting goals to manage fatigue and increasing physical abilities, 2) type of exercise: walking on common ground, 3) frequency: walking at least 5 days per week lasting for at least 2-4 weeks, 4) duration: walking at least 30-60minutes per day, 5) walking with moderate intensity that will achieve a rate of perceived exertion (RPE) and can be quantified by Borg's scale (11-14), and 6) progression: walking gradually toward a more advanced stage, for no more than 6 minutes (Jaisan & Jamchat, 2019; Klassen et al., 2020; Lee, Moon, Lee, Lee, & Park, 2019; Zedlitz et al., 2012). It is recommended that doing walking exercise in the evening (4-5 p.m.) every day may be more suitable because it is a comfortable time and can produce the greatest results on physical abilities (Klassen et al., 2020).

Based on previous studies (Michael & Macko, 2007; Noinawakul, Pinyopasakul, Kimpee, & Puwarawuttipanit, 2010; Zedlitz et al., 2012), it was found that all studies are designed to start the program at three months after stroke occurrence which may be too late and outside of the golden period for rehabilitation. Based on evidence, it has been found that starting the rehabilitation program late affects the quality of patients' recovery after stroke (Klassen et al., 2020). According to the brain plasticity theory, the rehabilitation process has to be started as quickly as possible in order to promote the regeneration of the brain (Johansson, 2000). The study reported that the amount of the substance called brain derived neurotrophic factor (BDNF) is reduced in individuals with fatigue, and the substance will increase statistically in volume after performing aerobic exercise (Morais et al., 2018). Therefore, the rehabilitation process should be designed to start as soon as possible after the onset of the disease, typically commencing 1 to 4 weeks after stroke, which would provide the best recovery of the nervous system (Alcantara et al., 2018; Klassen et al., 2020).

However, the management of PSF is still unclear in practice, and there are no guidelines for assessing and planning care in the acute phase. The researcher was interested in studying the effect of a walking enhancing program (WEP) on self-efficacy for walking, fatigue, and physical abilities among acute stroke patients. For this study, a 3-week walking enhancing program was chosen, because the duration for effective walking exercise for stroke patients is at least 2 weeks, and this is an appropriate time and standard of care after discharge that the physician appoints the patients to come for a follow-up at the outpatient stroke clinic.

The walking enhancing program (WEP) was develop based on self-efficacy theory (Bandura, 1997) and brain plasticity theory (Johansson, 2000). Although, based on the brain plasticity theory, the exercise program should last at least 8 weeks, as BDNF can be increased. However, the FITT principles (Billinger et al., 2015) have claimed that the effectiveness of walking in terms of improving physical ability is it is when continuously performed for at least 2-4 weeks. Moreover, some studies show that walking exercise is a kind of aerobic exercise which can increase physical ability starting from 2 weeks (Muangngoen & Saipan, 2019). Therefore, in this study, the researcher used brain plasticity theory and the FITT principles as a framework to guide aerobic exercise into the plan of care for people after a stroke, and a 3-week follow-up period was chosen because patients had to perform walking activities for at least 2 weeks.

Although physical ability in post-stroke patients could be increased by walking exercise, from the experience of rehabilitation of post-stroke patients, it was found that the patients had been taught and practiced walking skills from a physiotherapist. However, there was not continuous and sufficient practice due to lack of confidence in walking and fear of accidents while doing activities. In addition, the literature review showed that self-efficacy is an important requirement for post-stroke patients' engagement in exercise. It can determine how people feel, think, motivate themselves, and behave about their health (Caetano, Pacheco, Samora, Teixeira-Salmela, & Scianni, 2020). As a result, the rehabilitation is not effective for recovering. Therefore, regarding walking exercise together with self-efficacy for exercise, the confidence to do walking exercise significantly influenced the increase of physical ability in post-stroke patients (Gillespie et al., 2020; Zedlitz et al., 2012).

A pilot study of the present project found that after starting the program at 3 weeks, stroke patients had decreased the mean score of fatigue and increased the mean score of physical ability. Thus, researchers were interested in following up on the study outcomes at 3 weeks after the program had started. In addition, very few studies have been conducted to specifically investigate a walking exercise program designed to manage fatigue and promote physical ability in the acute phase.

This study aimed to examine the effects of a walking enhancing program which was specially designed to enhance perceived self-efficacy for walking, to decrease fatigue and to increase physical ability in acute stroke patients. The activities of the program consisted of education on fatigue management, including sleep, nutrition and physical activity, and enhancing self-efficacy for walking exercises to increase confidence in continuing rehabilitation activities. The stroke patients were promoted to perform the walking exercises as early as they had symptom stabilization.

The researchers sincerely hope that stroke patients who perform the walking exercise as determined in the program will have reduced fatigue and increased functional ability, which can lead to effective rehabilitation among post-stroke patients.

Objectives

The aim of this study was to examine the effect of a walking enhancing program on self-efficacy for walking, fatigue, and physical abilities among acute stroke patients.

Hypotheses

1. After receiving the walking enhancing program, the experimental group had higher mean of self-efficacy for walking scale (SEFWS) and six-minute walk test (6MWT) scores at 3 weeks than before starting the program.

2. After receiving the walking enhancing program, the experimental group had lower mean of fatigue severity score (FSS) at 3 weeks than before starting the program.

3. After receiving the walking enhancing program, the experimental group had higher mean of self-efficacy for walking scale (SEFWS) and six-minute walk test (6MWT) scores at 3 weeks than the control group.

4. After receiving the walking enhancing program, the experimental group had lower mean of fatigue severity score (FSS) at 3 weeks than the control group.

Conceptual Framework

The conceptual framework of this study was designed based on self-efficacy theory (Bandura, 1997) and brain plasticity theory (Johansson, 2000) and the modified FITT principles (Billinger et al., 2015) as a guide for utilizing these for exercise prescription among acute stroke patients. The walking enhancing program consisted of education on secondary prevention of recurrent stroke, post-stroke fatigue, fatigue management (nutrition, sleep, and physical ability), walking exercise technique, the activities to enhance self-efficacy for walking and practicing to do walking exercise correctly and continuously. The sources of self-efficacy used were enactive mastery experience, vicarious experience, verbal persuasion, and physiological and affective states. The activities for increasing self-efficacy were: 1) exchanging experiences of walking exercise, 2) daily record of walking, 3) providing verbal persuasion both during and after exercise, 4) providing video clips of walking exercise techniques in stroke patients who have been successful, and 5) daily assessment of patients regarding physical and emotional status while performing the walking enhancing program to evaluate their readiness and appropriateness to continue the program.

This program was implemented individually for samples in the experimental group twice during hospitalization. Monitoring of their walking exercise after discharge to home was done through 15-minute telephone calls. There was possibility for the program to increase self-efficacy for walking, decrease fatigue severity, and increase physical ability (Figure 1).

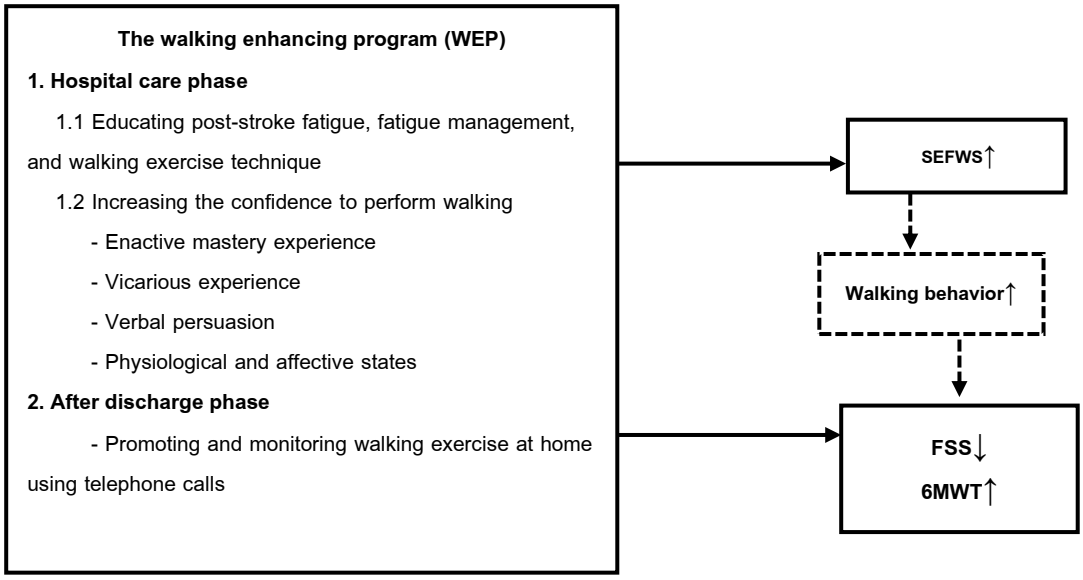

Figure 1. The conceptual framework of this study

Methodology

Population and Sample

This study collected data on eligible stroke patients who have received treatment at the stroke unit which was a Center of Excellence in the 4th Health Service Area, Saraburi. The inclusion criteria were as following: 1) 18 years old or over, 2) had mild to moderate severity of stroke according to the National Institute of Health Stroke Scale (NIHSS) (score of 0-15), 3) had a stable clinical condition for at least 24 hours with no stroke progression as evidenced by no change in NIHSS score and stable vital signs with less than 20% fluctuation, 4) were able to move on their own or walk using mobility aids with a Modified Rankin Scale (mRS) score of 0-3, 5), and were able to communicate in and read Thai language, and 6) were able to communicate by phone.

Patients were excluded if they had: 1) comorbidities with cognitive dementia and Alzheimer's disease with the Thai Mini-Mental State Examination score (MMSE-Thai 2002) less than 23, 2) severe depression and anxiety with the Hospital Anxiety and Depression Scale (HADS) over 11 for each aspect, and 3) comorbidities, such as heart disease or lung disease, which affected their ability to perform activities or walk. Discontinuation criteria were: 1) having recurrent or progressive stroke, 2) being discharged from hospital for more than one week, 3) unable to continue doing activities or participate in the study, and 4) moved to another place and unable to be tracked.

The sample size was calculated at the power of 80% with the significance level set at .05 by the G*Power program version 3.1.9.7. The effect size (.96) was based on a previous study by Zedlitz et al. (2012). In order to prevent drop out that may occur during the research process, the researchers increased the sample size by another 10 percent (Srisatidnarakul, 2020). Therefore, the sample size required 60 patients to test this hypothesis. However, as this result is

a preliminary analysis, 15 samples per group were used.

Thirty patients who were eligible were recruited for the study; 15 patients each were allocated to the experimental group and the control group. The control group received usual care including medical treatment, physiotherapy (PT) rehabilitation, and stroke education for secondary prevention, and then followed up for 2 weeks. Both groups were evaluated at baseline and at the end of week 3.

Research Instruments

Instruments used in this study included:

1. A demographic data form including age, gender, comorbidity, BMI, sleep time, stroke severity, level of neurological disabilities, and length of stay.

2. The self-efficacy for walking scale (SEFWS) was developed and modified from the self-efficacy for exercise scale by Resnick and Jenkins (2000), which had been translated into Thai by Harnirattisai, Johnson, & Kawinwonggowit, (2006). There are 9 questions, having a rating scale of 0-10, with a total score of 0-90. A high score means high perception of self-efficacy for walking and a low score means low self-efficacy for walking. The internal consistency was established with a pilot study with 30 stroke patients. The Cronbach's alpha coefficients demonstrated an internal consistency of .98 for this pilot study.

3. The fatigue severity scale (FSS) was developed by Krupp, LaRocca, Muir-Nash, and Steinberg (1989) and translated into Thai by Sawasdee et al. (2017). It consists of 9 questions and has a rating scale from 1-7, where 1 is disagree and 7 is strongly agree, with a possible score of 9-63. A high score value means high fatigue and a low score means low fatigue. The Cronbach's alpha coefficient was .96 for this pilot study.

4. The six-minute walk test (6MWT) was developed by the American Thoracic Society (2002) and aims to examine patient endurance. For this study, the distance that the participants can walk for 6 minutes was measured in meters. A high score means high physical ability, and a low score means low physical ability. The inter-rater reliability (IRR) between the researcher and physiotherapist was piloted with 6 stroke patients. The correlation coefficients revealed that the inter-rater reliability was 1.00.

5. The walking enhancing program (WEP) was developed based on self-efficacy theory (Bandura, 1997) and brain plasticity theory (Johansson, 2000), and was modified with the FITT principle to help guide exercise prescriptions among acute stroke patients. The program had been qualified with approval from 5 experts, including a professor of neurology, a professor of neurological physical therapy, a professor of nursing, a case manager of stroke patients, and the head of a stroke and neurological ward. The content validity index (CVI) was 1.0. Afterwards, the program was examined with 3 stroke patients to ensure that it was safe and appropriate for them. In addition, the standard of care in the of COVID-19 pandemic of COVID-19, time social distancing, hand washing, and mask wearing had been applied. Moreover, while conducting this study, the researcher used a safety waist belt in order to prevent fall during patient's walking.

Ethical Considerations

The study was approved by the Human Research Ethics Committee of Thammasat University (Science) COA No. 014/2565 and the Ethics Committee for Research involving Human Subjects of the hospital setting. After the permission for data collection, the researcher met the health care team to ask for cooperation in conducting the research. Moreover, the participants who were willing to participate in the study were asked to sign the Informed Consent Form.

Data Collection

Data were collected at the outpatient and inpatient departments of the Stroke Unit at a University Hospital in Pathum Thani between April to June in 2022. After the patients agreed to participate in the study and signed the consent form, the interview was completed using the demographic questionnaire. The researcher assessed the SEFWS, the FSS, and the 6MWT at baseline before starting the program. The participants were randomly assigned to either experimental or control group by the week of admission. Both the control and experimental groups received usual care. The walking enhancing program was conducted with the participants in the experimental group. For outcomes evaluation, all of the participants were measured with the instruments including the SEFWS, the FSS, and the 6MWT at 3 weeks after the experiment. The time used for outcome evaluation was approximately 15 minutes per person.

Data Analysis

The data were analyzed using descriptive statistics (frequency, percentage, and chi-square test), and a sample t-test was used to examine the difference between the important outcomes (SEFWS, FSS, and 6MWT) within and between the groups. All of these were employed to test the statistical significance at .05, and the distribution of all variables was visually and statistically assessed for normality.

The preliminary data of the 15 patients in the experimental group versus the 15 patients in the control group was analyzed. However, the final data analysis will be performed later.

Results

Thirty patients completed the study procedures and showed the following baseline characteristics. All participants were acute stroke patients, both male (56.67%) and female (43.33%), and had ages ranging from 44 to 77 years (mean=60.8, SD=1.66). Most of them (46.67%) were at the primary level of education, having comorbidity of HT (80%), DLP (66.67%), DM (36.67%), and other (AF, CAD) (13.33%). They had BMI ranging from 20.8 to 34.0 kg/m^2 (mean=26.65, SD=0.59), and had sleep time ranging from 5 to 9 hours (mean=7.5, SD=0.25). The stroke severity of the sample measured by the NIH stroke scale ranged from 0 to 6 (mean=2.73, SD=0.25). They had levels of neurological disability using the modified ranking scale (mRS) ranged from 0-3 (mean=2.1, SD=0.96), and had length of stay (LOS) from 2 to 7 days (mean=3.97, SD=1.61). There were no significant differences between groups for any of the following characteristics: age, gender, comorbidity, BMI, sleep time, stroke severity, level of neurological disabilities, and LOS (Table 1).

Table 1. Comparison of sample demographic characteristics between the two groups.

Characteristic	Categories	Total n (%)	CG (n=15) n (%)	EG (n=15) n (%)	Test value	P-value
Gender	Male	17(56.67)	10 (66.67)	7 (46.67)	1.222[b]	.269
	Female	13(43.33)	5 (33.33)	8 (53.33)		
Age	Age of 60.8 ± 1.66 (mean ± SD) (range 44-77 year)					
	<60	15(50.00)	9 (60.00)	6 (40.00)	1.200[b]	.273
	≥60	15(50.00)	6 (40.00)	9 (60.00)		
Education	Primary	14(46.67)	5 (33.33)	9 (60.00)	3.476[b]	.482
	High school	6(20.00)	4 (26.67)	2 (13.33)		
	Pre-Graduate	3(10.00)	1 (6.67)	2 (13.33)		
	Graduate	4(13.33)	3 (20.00)	1 (6.67)		
	Post- Graduate	3(10.00)	2 (13.33)	1 (6.67)		
Comorbidity	Diabetes mellitus	11(36.67)	7 (46.67)	4 (26.67)	1.292[b]	.256
	Hypertension	24(80.00)	14 (93.33)	10 (66.67)	3.333[b]	.068
	Hyperlipidemia	20(66.67)	13 (86.67)	7 (46.67)	5.400[b]	.020*
	Other (AF, CAD)	4 (13.33)	1 (6.67)	3 (20.00)	1.154[b]	.283
BMI	BMI of 26.65±0.59 (mean ± SD) (range 20.8-34.0 kg/m^2)					
			26.45(3.03)	26.85(3.57)	-.330[a]	.744
Sleep time	Sleep time of 7.5± 0.25 (mean ± SD) (range 5-9 hrs.)					
			6.93 (1.10)	8.07 (1.39)	-2.480[a]	.190
NIHSS	NIHSS of 2.73 ± 0.25 (mean ± SD) (range 0-6 score)					
			3.07 (1.33)	2.40(1.40)	1.333[a]	.193
Length of stay	Length of stay of 3.97. ± 1.61 (mean ± SD) (range 2-7)					
			4.33 (1.84)	3.60 (1.30)	-1.262[a]	.217
mRS	mRS of 2.1 ± 0.96 (mean ± SD) (range 0-3)					
			2.7 (0.88)	2.13 (1.06)	-.187[a]	.853

[a] = Independent t-test, [b] = Pearson chi-square, * = Significant, p-value = .05, EG = Experimental group, CG = Control group, mRS = modified ranking scale, BMI = body mass index, NIHSS = National Institute of Health Stroke Scale

Before starting the program, no statistically significant differences were found between groups on any baseline outcome variables (SEFWS, FSS, and 6MWT) (t=-1.027, p>.05; t= .733, p>.05; t=-.862, p>.05, respectively) (Table 2). The experimental group had significantly higher mean SEFWS and 6MWT scores at 3 weeks than the control group (t=9.613, p<.05; t=3.062, p<.05). They also had a significantly lower mean score for FSS at week 3 than the control group (t=-8.090, p<.05) (Table 2).

Table 2. Independent sample t-test to evaluate mean and standard deviation of the SEFWS, the FSS and 6-MWT between the CG and the GG at baseline and follow-up at week 3 (n=30)

Variable	CG (n=15)		EG (n=15)		Test value	P-value
	Mean	(SD)	Mean	(SD)		
SEFWS Baseline	41.27	(17.67)	35.67	(11.57)	-1.027	.31
Follow-up at week 3	45.80	(11.52)	79.53	(7.21)	9.613	.00*
FSS Baseline	36.60	(11.67)	39.13	(6.56)	.733	.47
Follow-up at week 3	40.80	(6.24)	24.60	(4.61)	-8.09	.00*
6MWT Baseline	132.48	(84.58)	109.27	(61.13)	-.862	.40
Follow-up at week 3	177.27	(60.47)	303.13	(147.29)	3.062	.01*

* = P< .05, Independent Sample T-test, CG = Control group, EG = experimental group

Moreover, the experimental group had significantly higher mean SEFWS and 6MWT scores at 3 weeks compared within the group at baseline (t= 15.094, p<.05; t= 7.539, p<.05) and had a significantly lower mean FSS score than compared within the group at baseline (t=-8.353, p<.05) (Table 3).

Table 3. Dependent sample t-test to evaluate mean and standard deviation of the SEFWS, the FSS, and 6-MWT of the experimental group between at baseline and follow-up at week 3 (n=15)

Variable	Baseline		Follow-up at week 3		Test value	P-value
	Mean	(SD)	Mean	(SD)		
SEFWS	35.67	(11.57)	79.53	(7.21)	15.094	.00*
FSS	39.13	(6.56)	24.60	(4.61)	-8.353	.00*
6MWT	109.27	(61.13)	303.13	(147.29)	7.539	.00*

* = P< .05, Dependent Sample T-test

Discussion

The results of this study showed that the group participated in the walking enhancing program had mean scores for SEFWS and 6MWT that were statistically significantly higher than before starting the program, and than those of the control group. In addition, they had a mean FSS which was statistically significantly lower than before starting the experiment, and than the

control group. The mean scores of self-efficacy for walking in the experimental group were possibly improved because the participants had increased their confidence to perform walking using the activities designed based on four sources of self-efficacy by Bandura (1997). These findings supported that using Bandura's four sources of self-efficacy (1997), enactive mastery experiences, vicarious experiences, verbal persuasion, and emotional and physiological status, can help increase the behavior to perform walking. Regarding vicarious experience, observing and learning from the model (successful walking person) in a video clip can help the experimental group participants decrease fear and anxiety, while believing that they can do the same as the person performing in the video. This finding is consistent with a study by Noinawakul et al. (2010) which applied a Video Compact Disc (VCD) about walking exercise in stroke patients as a model to demonstrate that stroke patients can successfully perform walking exercise in increasing walking ability and endurance. Result of the study revealed statistically significantly increased confident in regard to performing exercise and increased endurance ($p < .01$).

The researchers also used verbal techniques to encourage participants to do walking exercise correctly and continuously during their participation in the program. In addition, the 15-minute telephone calls allow the participant to discuss, and the research can help the participant to overcome barrier and to do walking continuously. Moreover, for emotion and physiological state, the researcher prepared the participants to be ready to perform walking by educating and training to help decrease their fear and anxiety and give them the confidence to perform walking.

Moreover, the experimental group had been provided with information regarding stroke, fatigue, and the benefit of walking for rehabilitation, and trained in walking exercise techniques for stroke patients. In addition, the participants were given the opportunity to exchange their successful experiences regarding walking with the researcher by using a daily walking record. Doing these activities helped the researchers know how much walking they had performed, the problems they faced, and how to deal with those problems.

The results showed that the experimental group who received the walking enhancing program had an increased mean score of physical ability (6 MWT) at week 3 of the program, possibly because doing the walking as designed in the program continuously could help them to improve their activities and their endurance in performing walking exercise. Walking is a kind of physical activity which is convenient and safe for stroke patients and can lead to the quality of rehabilitation (Saunders et al., 2016). Regarding walking techniques, applying the FITT (frequency, intensity, time, and type) principles (Billinger et al., 2015) for designing walking programs for stroke patients can benefit them. Observing the walking record form of the participants, it was found that the participants in the experimental group walked frequently, 3-5 times a week, at a moderate level (11-14) of intensity assessed by Borg's scale, and increased the duration of walking progressively to 20-45 minutes. The recorded data demonstrate that the participants in the experimental group could perform walking exercise effectively and continuously. In addition, the patients received the walking enhancing program with a mean length of stay of 3.97 days

(SD=1.61). Programs initiated as early as 2 or 3 days after a stroke resulted in better rehabilitation. Based on the concept of brain plasticity, it is believed that the brain will make structural changes by reducing the death of brain cells and greatly increasing the links among neurons if there is a rapid and continuous recovery or stimulation after the illness (Johansson, 2000). This is consistent with a study by Klassen et al. (2020) which found that walking training in post-stroke patients in the first week could improve the physical ability of stroke patients within 2 weeks.

The experimental group had a statistically significant lower mean score for the fatigue severity scale than before starting the program, and lower than the control group. This may be due to the fact that the experimental group was educated on the management of fatigue in stroke patients in terms of adjusting sleep, nutrition, and physical activity. This health education helped the participants to have good self-care for fatigue management. This is consistent with a study by Clarke et al. (2012) which found that educating post-stroke patients about managing fatigue can reduce fatigue. Moreover, from the follow-up of patients who participated in the present study, it was found that the patients were able to follow the principles of FITT correctly and continuously for at least 2 weeks. Doing walking which is an aerobic exercise could have benefits by reducing fatigue. This finding was similar to that of Tai et al. (2022) which showed that exercise training has a positive effect on sleep and fatigue in post-stroke patients. Moreover, the findings of this study were consistent with Zedlitz et al. (2012) which showed that cognitive training combined with walking (graded activity training) can reduce fatigue in stroke patients and greatly improves physical ability recovery.

Therefore, it can be concluded that the walking enhancing program can help improve self-efficacy for walking, increase physical abilities, and decrease fatigue resulting in qualified rehabilitation among stroke patients in the acute phase.

Conclusion and Recommendations

The walking enhancing program strategies are important strategies for acute stroke patients to regain their recovery. The multidomain walking enhancing program, implemented as early as possible and within three months, had to be applied so that stroke patients could regain their physical ability after a stroke. Moreover, technology applications regarding walking exercise programs are recommended.

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References

Aarnes, R., Stubberud, J., & Lerdal, A. (2020). A literature review of factors associated with fatigue after stroke and a proposal for a framework for clinical utility. *Neuropsychological Rehabilitation, 30*(8), 1449-1476. doi:10.1080/09602011.2019.1589530

Alcantara, C. C., García-Salazar, L. F., Silva-Couto, M. A., Santos, G. L., Reisman, D. S., & Russo, T. L. (2018). Post-stroke BDNF concentration changes following physical exercise: A systematic review. *Frontiers in Neurology, 9*, 637.

American Thoracic Society. (2002). ATS statement: Guidelines for the six-minute walk test. *American Journal of Respiratory and Critical Care Medicine, 166*(1), 111-117. doi:10.1164/ajrccm.166.1.at1102

Avan, A., Digaleh, H., Di Napoli, M., Stranges, S., Behrouz, R., Shojaeianbabaei, G., ... Azarpazhooh, M. R. (2019). Socioeconomic status and stroke incidence, prevalence, mortality, and worldwide burden: An ecological analysis from the Global Burden of Disease Study 2017. *BMC Medicine, 17*(1), 191. doi:10.1186/s12916-019-1397-3

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: W.H. Freeman.

Barker-Collo, S., Krishnamurthi, R., Ikeda, T., TeAo, B., Green, G., Ratnasabapathy, Y., ... Jones, K. (2022). Methodology of the fatigue after stroke educational recovery group randomized controlled trial. *International Journal of Stroke, 17*(1), 120-124.

Billinger, S. A., Arena, R., Bernhardt, J., Eng, J. J., Franklin, B. A., Johnson, C. M., ... Roth, E. J. (2014). Physical activity and exercise recommendations for stroke survivors: A statement for healthcare professionals from the American Heart Association/ American Stroke Association. *Stroke, 45*(8), 2532-2553.

Billinger, S. A., Boyne, P., Coughenour, E., Dunning, K., & Mattlage, A. (2015). Does aerobic exercise and the FITT principle fit into stroke recovery? *Current Neurology and Neuroscience Reports, 15*(2), 1-8.

Caetano, L. C. G., Pacheco, B. D., Samora, G. A. R., Teixeira-Salmela, L. F., & Scianni, A. A. (2020). Self-efficacy to engage in physical exercise and walking ability best predicted exercise adherence after stroke. *Stroke Research and Treatment, 2020*, 2957623. doi:10.1155/2020/2957623

Choi-Kwon, S., Han, S. W., Kwon, S. U., & Kim, J. S. (2005). Poststroke fatigue: Characteristics and related factors. *Cerebrovascular Diseases, 19*(2), 84-90. doi:10.1159/000082784

Clarke, A., Barker-Collo, S. L., & Feigin, V. L. (2012). Poststroke fatigue: Does group education make a difference? A randomized pilot trial. *Topics in Stroke Rehabilitation, 19*(1), 32-39.

Gillespie, D. C., Barber, M., Brady, M. C., Carson, A., Chalder, T., Chun, Y., ... Haig, E. (2020). Study protocol for POSITIF, a randomised multicentre feasibility trial of a brief cognitive-behavioural intervention plus information versus information alone for the treatment of post-stroke fatigue. *Pilot and Feasibility Studies, 6*(1), 1-14.

Harnirattisai, T., Johnson, R. A., & Kawinwonggowit, V. (2006). Evaluating functional activity in older Thai adults. *Rehabilitation Nursing, 31*(3), 124-128.

Harniratisai, T. (2018). *Nursing care for enhancing the physical activity and exercise of older adult and their health* (*Vol. 1*). Pathum Thani: Thamasat University Press.

Jaisan, T., & Jamchat, R. (2019). Development of gait training program at home in stroke natients with assistive devices. *Medical Journal of Srisaket Surin Buriram Hospitals, 34*(3), 349-357. (in Thai)

Joa, K.-L., Kim, W.-H., Choi, H.-Y., Park, C.-H., Kim, E.-S., Lee, S.-J., ... Jung, H.-Y. (2017). The effect of sleep disturbances on the functional recovery of rehabilitation inpatients following mild and moderate stroke. *American Journal of Physical Medicine & Rehabilitation, 96*(10), 734-740.

Johansson, B. B. (2000). Brain plasticity and stroke rehabilitation. The willis lecture. *Stroke, 31*(1), 223-230. doi:10.1161/01.str.31.1.223

Junsiri, P. (2021). Caregiver burden among caregivers of stroke patient in intermediate care service of Kosumpisai Hospital. *Mahasarakham Hospital Journal, 18*(2), 72-80. (in Thai).

Klassen, T. D., Dukelow, S. P., Bayley, M. T., Benavente, O., Hill, M. D., Krassioukov, A., ... Schneeberg, A. (2020). Higher doses improve walking recovery during stroke inpatient rehabilitation. *Stroke, 51*(9), 2639-2648.

Krupp, L. B., LaRocca, N. G., Muir-Nash, J., & Steinberg, A. D. (1989). The fatigue severity scale: Application to patients with multiple sclerosis and systemic lupus erythematosus. *Archives of Neurology, 46*(10), 1121-1123. doi:10.1001/archneur.1989.00520460115022

Lee, J.-M., Moon, H.-H., Lee, S.-K., Lee, H.-L., & Park, Y.-J. (2019). The effects of a community-based walking program on walking ability and fall-related self-efficacy of chronic stroke patients. *Journal of Exercise Rehabilitation, 15*(1), 20.

Lekander, I., Willers, C., von Euler, M., Lilja, M., Sunnerhagen, K. S., Pessah-Rasmussen, H., & Borgström, F. (2017). Relationship between functional disability and costs one and two years post stroke. *PLOS ONE, 12*(4), e0174861. doi:10.1371/journal.pone.0174861

Michael, K., & Macko, R. F. (2007). Ambulatory activity intensity profiles, fitness, and fatigue in chronic stroke. *Topics in Stroke Rehabilitation, 14*(2), 5-12.

Morais, V. A. C. d., Tourino, M. F. d. S., Almeida, A. C. d. S., Albuquerque, T. B. D., Linhares, R. C., Christo, P. P., ... Scalzo, P. L. (2018). A single session of moderate intensity walking increases brain-derived neurotrophic factor (BDNF) in the chronic post-stroke patients. *Topics in Stroke Rehabilitation, 25*(1), 1-5. doi:10.1080/10749357.2017.1373500

Muangngoen, M., & Saipan, P. (2019). The effectiveness of robotic assisted gait training (Exoskeleton Devices: Lokomat) in stroke patients: A systematic review. *Journal of The Department of Medical Services, 44*(1), 57-62. (in Thai).

Noinawakul, U., Pinyopasakul, W., Kimpee, S., & Puwarawuttipanit, W. (2010). The effects of a walking exercise program on perceived self-efficacy and functional capacity in stroke patients with hemiparesis. *Nursing Science Journal of Thailand, 28*(4). 45-53.

Resnick, B., & Jenkins, L. S. (2000). Testing the reliability and validity of the self-efficacy for exercise scale. *Nursing Research, 49*(3). 154-159.

Saunders, D. H., Sanderson, M., Hayes, S., Kilrane, M., Greig, C. A., Brazzelli, M., & Mead, G. E. (2016). Physical fitness training for stroke patients. *The Cochrane Database of Systematic Reviews, 3*(3), CD003316. doi.org/10.1002/14651858.CD003316.pub6

Srisatidnarakul, B. (2020). *Effect size, power analysis calculating the optimal sample size using the G*Power sofeware* (Vol. 1). Bangkok: Chulalongkorn University Book Center.

Srisawat, S., Kumpolsiri, T., & Panuthai, S. (2021). Food consumption behaviors and nutritional status in older persons with stroke. *Nursing Journal, 48*(1), 54-66 (in Thai).

Strategy and Planning Division Ministry of Public Health. (2021). *Public health statistics.* Retrieved from http://dmsic.moph.go.th/index/detail/8297 (in Thai)

Tardy, A..L., Pouteau, E., Marquez, D., Yilmaz, C., & Scholey, A. (2020). Vitamins and minerals for energy, fatigue and cognition: A narrative review of the biochemical and clinical evidence. *Nutrients, 12*(1), 228.

Thammasat University Hospital. (2020). *Statistics of stroke patients admitted to Thammasat Hospital*. Pathum Thani: Thammasat University Hospital.

Zedlitz, A. M., Rietveld, T. C., Geurts, A. C., & Fasotti, L. (2012). Cognitive and graded activity training can alleviate persistent fatigue after stroke: A randomized, controlled trial. *Stroke, 43*(4), 1046–1051. doi.org/10.1161/STROKEAHA.111.632117