Abstract

Purpose: This study aimed to investigate the effect of a walking exercise program on perceived self-efficacy and functional capacity in stroke patients with hemiparesis.

Design: Experimental research design, pretest-posttest control group design.

Methods: Sixty-four stroke patients aged 45 years old and over who had motor power greater or equal to grade 3 and had an ability to walk with or without gait aids at least 30 ft were recruited. The samples were randomly selected and divided equally into two groups. Stroke patients in the experimental group received 35 days of a walking exercise program while those in the control group received the usual rehabilitation program. Data was collected by using a demographic questionnaire, perceived self efficacy for walking exercise questionnaire, and functional capacity record form. Data was analyzed by using descriptive statistics, paired t-test, and the analysis of covariance.

Main findings: The results revealed that levels of perceived self-efficacy of stroke patients in the experimental group were significantly higher than those in the control group (p < .05). The levels of functional capacity of the patients in the experimental group were also significantly higher than those in the control group (p < .01).

Conclusion and Recommendations: The findings suggested that stroke patients could gain benefits from the walking exercise program. This program could be used to promote and sustain perceived self-efficacy and functional capacity in stroke patients with hemiparesis.

Keywords: walking exercise, perceived self-efficacy, functional capacity, stroke patients, hemiparesis


Introduction

Cerebrovascular disease (CVD), or stroke, is a serious public health problem in the world due to high mortality and disability rates. In 2007, it was the third leading cause of death after heart diseases and cancer in the United State, Europe and Asia, respectively. Moreover, two third of stroke survivors had disabilities. Hemiparesis is one of the most common disabilities resulting from stroke that can dramatically reduce the functional capacity of the patients. In stroke patients with hemiparesis, functional capacity can be reduced because of reduced activity and subsequent changes in metabolic and vascular functions.

Walking exercise is one strategy used to improve functional capacity which is considered safe and convenient for stroke patients. Evidently, walking exercise causes an increase in cardiac output and also abilities of the body to utilize maximal volume of oxygen (VO₂ max). It could improve blood distribution to all body tissue thus lead to enough energy synthesis. Furthermore, walking exercise helps the body to metabolize nutrients, increase muscular endurance and muscle strength. Many research studies have suggested that walking exercise is an effective strategy to improve cardiorespiratory fitness and therefore functional capacity in stroke patients.

Although functional capacity in stroke patients could be increased by exercise, a study revealed that stroke patients who had low self-efficacy were less likely to perform the exercise. Low self-efficacy levels in stroke patients may be a natural consequence post stroke or a result of the psychological impact that influences perceived self-efficacy in stroke patients. Perceived self-efficacy refers to as a person's confidence in his or her ability to engage in a specific activity. The stronger that he or she believes in the outcome of that activity, the more likely that he or she will initiate and adhere to the behavior. It is essential that these beliefs are adopted to maintain exercise behavior in older adults and also patients with stroke.

However, very few studies have been conducted specifically to investigate a walking exercise program designed to promote functional capacity in stroke patients with hemiparesis. Previously, Chantaravej et al. studied homodynamic responses of a home-based walking program in stroke patients and found that this program could improve functional status of the patients. The present research study aimed to examine the effect of a walking exercise program, which was a hospital-based program, that was specially designed to enhance perceived self-efficacy and to increase functional capacity in stroke patients with hemiparesis.

Hypotheses

1. After receiving the walking exercise program, stroke patients with hemiparesis would have higher mean scores of perceived self-efficacy to walking exercise than before receiving the program.
2. Stroke patients with hemiparesis who received the walking exercise program would have higher mean scores of perceived self-efficacy for walking exercise than those who received usual rehabilitation.
3. After receiving the walking exercise program, stroke patients with hemiparesis would have higher mean scores of functional capacity than before receiving the program.
Stroke patients with hemiparesis who received the walking exercise program would have higher mean scores of functional capacity than those who received usual rehabilitation.

**Method**

This research was an experimental study with a pretest-posttest control group design. The population were in-patients, male and female, aged 45 years old and above. These patients had ischemic stroke with hemiparesis and were being treated at a stroke unit in a general hospital in central Thailand. Cognitive status was intact and patients had motor power of all limbs ≥ grade 3 with no spasticity, an ability to walk with or without gait aids at least 30 ft, no existing co-morbidities that contradicted exercise such as myocardial infarction, and had a primary caregiver. The estimation of sample size was calculated based on power analysis. The effect size was calculated from a previous study, using α = .05, power = .80, and medium effect size = .70. The estimated sample size was 64 patients. The samples were divided equally into a control and experimental group by using a table of random numbers. The experimental group received the walking exercise program, whereas the control group received usual rehabilitation.

**Instrumentation**

The study was conducted using a walking exercise program and the research instruments for data collection. The walking exercise program was developed based on the previous walking exercise program established by Chantaravej et al., and was validated by six experts including two nurse educators, a stroke nurse, a neurologist, a physician specialized in rehabilitative medicine, and a physiotherapist. The researcher integrated the Bandura’s self-efficacy concept into this program, comprising 4 aspects, including enactive mastery experience, vicarious experiences, verbal persuasion, and emotional and physiological status as follows.

Enactive mastery experiences: The researcher provided information about stroke and trained walking exercise techniques for patients. The activities included a discussion with each patient about his or her previous experiences to exercise and benefits of the walking exercise.

Vicarious experiences: Patients were shown with Video Compact Disc (VCD) about walking exercise techniques in stroke patients and outcomes of the exercise.

Verbal persuasion: The researcher provided verbal persuasion both during and after exercise. Examples of successful participants practicing exercise were shown, and encouragement from the researcher and caregiver were also provided.

Emotional and physiological status: Participants were assessed on a daily basis in regard to physical and emotional status during performing the walking exercise program to evaluate readiness and appropriateness in order to continue the walking exercise program.

The research instruments for data collection included a demographic questionnaire, a perceived self efficacy for walking exercise questionnaire, and a functional capacity record form. The functional capacity record form was used to assess the endurance of each patient to perform activities as revealed by an ability to walk measured by using a 6-minute walk test (6 MWT). The 6 MWT demonstrated the longest distance in meters that each patient was able to walk within six minutes. The perceived self efficacy for walking exercise questionnaire consisted of ten questions asking each patient to rate an extent to which he or she agreed or disagreed to his or her self efficacy for this exercise. Total scores of perceived self efficacy were divided in to three levels: high level (>23), moderate level (19–23) and low level (<19). All research instruments were validated by six experts, and the reliability of the instruments were 0.83.

**Procedures**

Approval for the conduct of this research was sought from the Mahidol University Institutional
Review Board and the Ethics Committee for Research involving Human Subjects of the hospital research setting. After permission was gained, the researcher had a meeting with the health care team to ask for cooperation in the research setting. The researcher then informed patients and relatives about research objectives, expected benefits, and potential effects. Consent forms were gained prior to collecting the data.

Data collection began by gathering information about personal data, perceived self-efficacy for walking exercise, and functional capacity in both groups of patients. Participants in the control group received usual rehabilitation from a physiotherapist, including exercising balance and gait for 20-30 minutes each time, three times a week. Participants in the experimental group received a walking exercise program performed by the researcher. This program consisted of a provision of an education program on basic knowledge about stroke disease and walking exercise to enhance enactive mastery experiences of patients. The VCD and booklet about stroke and walking exercise were given to increase their vicarious experiences. The participants had walking exercise every day in the morning, while caregivers were asked to encourage the patients to perform walking exercise. Physical and emotional status was assessed on a daily basis during performing the exercise program. At day 7, or day at discharge, day 21, and day 35, all participants were followed up to evaluate their functional capacity and perceived self-efficacy to walking exercise.

**Findings**

Demographic data related to personal characteristics, health status, and histories of exercise of patients were analyzed. Participants in both groups were mostly male (62.5 % in experimental and 56.3% in control group). Average age was 61.7 years in the experimental group, and 62.7 years in the control group. The majority of the experimental group demonstrated right sided weakness (53.1%), while the control group demonstrated left sided weakness (53.1%). Both groups mostly had motor power at grade 4 (40.6% in the experimental, and 46.9% in the control group) and had no previous hemiparesis. Most of the participants in both groups had hypertension (78.1% in experimental group, 75 % in control group) and some had diabetes (31.3% in experimental group, 40.6% in control group). The majority of caregivers in the experimental group were patients' partners (43.8%), while half of the caregivers in the control group were their children (50%).

Most of the caregivers in both groups had no prior experiences in taking care of patients with hemiparesis (84.4% in the experimental group, 90.6% in the control group). In regard to history of exercise in the past 3 months, more than half of both groups had no prior exercise experience (59.4% in the experimental group, and 65.6% in the control group).

Chi-square test demonstrated that both groups had no statistically significant difference in the demographic data related to characteristics, health status, and exercise behaviors with the level of significance at .05.

When comparing the level of perceived self-efficacy between groups, the finding showed that the mean scores of perceived self efficacy at day 7 were 28.50 in the experimental group, and 26.47 in the control group. At day 21 the mean scores of perceived self efficacy were 28.66 in the experimental group, and 24.91 in the control group. At day 35 the mean scores of perceived self efficacy were 28.94 in the experimental group, and 25.53 in the control group, respectively. Statistically, in the experimental group the mean scores of perceived self
efficacy at day 35 post joining the study were significantly higher than those at pre-test. In the control group, the mean scores of a perceived self efficacy at day 35 post joining the study were not statistically significant different (p > .05) when compared to pre-test as shown in table 1. Analysis of covariance in the mean scores of perceived self efficacy of the patients between groups using pre-test perceived self efficacy as a covariate also showed that the perceived self-efficacy in the experimental group was significantly greater than in the control group (p < .01) as shown in table 2.

### Table 1: Comparison of mean scores of perceived self-efficacy at pre-test and at Day 35 post study between groups using Paired t-test

<table>
<thead>
<tr>
<th>Sample group</th>
<th>Pre-test</th>
<th>Day 35</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Experimental</td>
<td>26.97</td>
<td>2.64</td>
<td>28.94</td>
</tr>
<tr>
<td>Control</td>
<td>25.44</td>
<td>2.78</td>
<td>25.53</td>
</tr>
</tbody>
</table>

*p < .05, ns = non-significant

### Table 2: Analysis of Covariance in the mean scores of perceived self efficacy of the patients between groups using pre-test perceived self efficacy as a covariate

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariate (Pre-study)</td>
<td>1</td>
<td>24.363</td>
<td>24.363</td>
<td>8.013</td>
<td>.006</td>
</tr>
<tr>
<td>Between group</td>
<td>1</td>
<td>137.783</td>
<td>137.78</td>
<td>45.31</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Within group</td>
<td>61</td>
<td>185.480</td>
<td>3.041</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>64</td>
<td>47865.000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In relation to the level of functional capacity between the experimental and control groups, the findings showed that the average 6-minute walk distance (6MWD) of patients in the experimental group and the control group after joining the program (at day 35) was significantly longer than that before joining the program (at pre-test) (p < .05) as shown in table 3. Analysis of Covariance in the mean scores of average 6-minute walk distance between groups using the pre-test average 6MWD as a covariate showed that the average 6MWD in the experimental group was significantly longer than that in the control group (p < .01) as shown in table 4.

### Discussion

From the findings, the mean scores of perceived self-efficacy in the control group after participating in this study were less than those in the experimental group. As revealed, the control group received the usual rehabilitative care by the physiotherapist for only one hour a day, three days a week, therefore, they had limited time to learn and practice their exercise activities. It was difficult for patients to discuss or share feelings and experiences with staff. These difficulties might also have had an impact on the patients' beliefs on their capacity or motivation to perform exercise behaviors.
### Table 3: Comparison of mean scores of average 6-minute walk distance pre-test and at Day 35 post study between groups using Paired t-test

<table>
<thead>
<tr>
<th>Sample group</th>
<th>Pre-test</th>
<th>Day 35</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Experimental</td>
<td>189.53</td>
<td>113.35</td>
<td>315.31</td>
</tr>
<tr>
<td>Control</td>
<td>164.60</td>
<td>109.31</td>
<td>239.31</td>
</tr>
</tbody>
</table>

* p < .05

### Table 4: Analysis of Covariance in the mean scores of average 6-minute walk distance between groups using pre-test average 6-minute walk distance as a covariate

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariate (Pre-test)</td>
<td>1</td>
<td>345439.527</td>
<td>345439.527</td>
<td>149.479</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Between group</td>
<td>1</td>
<td>55515.182</td>
<td>55515.182</td>
<td>24.023</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Within group</td>
<td>61</td>
<td>140968.537</td>
<td>2310.960</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>64</td>
<td>5500662.040</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On the other hand, the experimental group in this study received both routine rehabilitative care by the physiotherapist and also the walking exercise program daily by the researcher. It could be explained that the participants in the experimental group developed their self-efficacy through interpreting information and understandings from four major sources of the walking exercise program. The four major sources consisted of enactive mastery experience or accomplishment, vicarious experience or observation learning, verbal persuasion from peer support, and the evaluation of physiological or emotional conditions. The results in this study were consistent with previous studies in relation to the effect of exercise in other groups of population. In many studies, perceived self-efficacy was often increased after some interventions were given. For example, Wongkaoom studied about self-efficacy and an exercise program to investigate elder’s exercise behaviors. She found that the experimental group that received the intervention program had had greater perceived self efficacy and had become more active with their exercise behaviors. The use of the exercise program employing the concept of self-efficacy therefore could promote the levels of perceived self efficacy and exercise behaviors of patients.

Furthermore, the findings revealed that there was increased functional capacity in the control group at day 35 after participating in this study. This may be due to the fact that the participants in the control group received the usual rehabilitation program as part of routine standardized care in the hospital. The effect of this routine rehabilitation program could therefore improve in the physical fitness of patients. As noted in other studies, the courses of functional recovery in stroke patients by all means help improve their functional capacity but this improvement would take time and effort that is often revealed in the first 3 to 6 months. The functional
capacity improvement in the control group was however significantly less than that in the experimental group after the interventions. One plausible explanation for this finding was that the control group had had limited time to learn about stroke information and practice exercise activities, so it might affect the continuity of their exercise practice and also the possibility to maintain this practice in a longer period.

In addition, the experimental group received the walking exercise program that integrated both physical activities and also self-efficacy strategies to promote exercise behaviors. Several previous studies indicated that perceived self-efficacy could influence exercise behaviors. These studies explained that when patients had an increase in perceived self-efficacy, their exercise behaviors were potentially increased. This finding was congruent with the concept of Bandura that perceived self-efficacy plays an important role in helping individuals overcome barriers and maintain exercise behaviors. The results of continuous walking exercise to improve functional capacity as this program was performed step by step to prepare readiness of the patients. As revealed, the findings in this study showed an improvement in the functional capacity in the experimental group. This might be due to several beneficial physiological changes according to the fact that exercise help increasing muscular endurance and muscle strength. Moreover, an increase in muscle mass or a reduction or prevention of the disused atrophy of muscle may also strengthen the bone strength and capacity.

Furthermore, walking exercise helps increase functional capacity by improving intensity of cardiac contraction, thus increasing cardiac output and maximal oxygen uptake (VO₂max) leading to a greater functional capacity. In a previous study, Chantaravej and colleagues studied the homodynamic responses of the home based walking program in 11 stroke patients. The results suggested that this home-based walking exercise program benefitted stroke patients by reducing the myocardial oxygen consumption and was safe to be prescribed for stroke patients.

Overall, the results of this study provided evidence that the walking exercise program could improve perceived self-efficacy and functional capacity in stroke patients. The hypotheses in the present study were also well supported by a number of previous studies.

**Conclusion**

From the findings in this study, the researcher concluded that the walking exercise program could promote perceived self-efficacy and functional capacity for stroke patients with hemiparesis. The implications and applications of the research findings to nursing practice were outlined. Nurses should use a walking exercise program to promote quality of care for stroke patients with hemiparesis. Also, collaborative practice between nurses and multidisciplinary team is essential in order to maximize the benefits of this program. Moreover, family caregivers should be involved in rehabilitative care so as to stimulate and support stroke patients to participate in this program. This involvement would enable the patients to sustain their behavior and enhance good relations between patients and caregivers at home. For most effective benefits, nursing staff should be trained for knowledge and skill acquisition in walking exercise, as well as skills to promote perceived self-efficacy to gain basic understanding of this intervention. Future research should follow up this group of patients for a longer period, for example one year, to examine the long term outcomes of this intervention. In addition, walking exercise should be expanded to other groups of patients with similar characteristics of the participants in this study in order to evaluate for health outcomes.

**References**


ผลของโปรแกรมเดินออกกำลังกายด้วยการบริหารสมรรถนะในตนเองและความทนทานในการทำกิจกรรมของผู้ป่วยโรคหลอดเลือดสมองที่มีภาวะอัมพาตครึ่งซีก *

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บัณฑิตวิทยาลัย มหาวิทยาลัยมหิดล

บทคัดย่อ
วัตถุประสงค์: เพื่อศึกษาผลของการเดินออกกำลังกายด้วยการบริหารสมรรถนะในตนเองและความทนทานในการทำกิจกรรมของผู้ป่วยโรคหลอดเลือดสมองที่มีภาวะอัมพาตครึ่งซีก

วิธีดำเนินการวิจัย: กลุ่มตัวอย่างเป็นผู้ป่วยโรคหลอดเลือดสมองอายุ 45 ปีขึ้นไป มีภาวะอัมพาตครึ่งซีก โดยมีระดับการเดินออกกำลังกาย 3 ขั้นไป และสามารถเดินได้ด้วยตนเองหรือมีผู้ช่วยเหลือเป็นระยะทางอย่างน้อย 30 ฟุต คัดเลือกกลุ่มตัวอย่างตามเกณฑ์ที่กำหนดและการสุ่มตัวอย่างด้วยตารางเลขสุ่ม ทำการสุ่มตัวอย่างตัวอย่างสุ่มจำนวน 2 กลุ่ม โดยกลุ่มทดลองจะได้รับโปรแกรมเดินออกกำลังกายเป็นระยะเวลา 35 วัน ส่วนกลุ่มควบคุมจะได้รับการฟื้นฟูสภาพตามปกติ

วิเคราะห์ข้อมูล: การวิเคราะห์สถิติเชิงบรรยาย ค่าคิว การทดสอบค่าที่แบบสองกลุ่มสัมพันธ์ และการวิเคราะห์ความแปรปรวนร่วมผล

ผลการวิจัย: ผู้ป่วยโรคหลอดเลือดสมองที่มีภาวะอัมพาตครึ่งซีกในกลุ่มทดลองมีความเชื่อมั่นในสมรรถนะในการทำกิจกรรมมากขึ้นอย่างมีนัยสำคัญทางสถิติ (p < .05) และมีความทนทานในการทำกิจกรรมเพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติ (p < .01)

คำสำคัญ: โปรแกรมเดินออกกำลังกาย การบริหารสมรรถนะในตนเอง ความทนทานในการทำกิจกรรม ผู้ป่วยโรคหลอดเลือดสมอง ภาวะอัมพาตครึ่งซีก