The effectiveness of strengthening leg muscles physical exercise promotion program for preventing falls of the elderlies in Thailand

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Abstract

This quasi-experimental research aimed to study the effectiveness of a physical exercise promotion program for strengthening leg muscles to prevent falls of the elderlies. Protection motivation theory was employed as a theoretical framework in this study. The experimental group comprised 30 elderly people aged 60 years and older who received medical care at Pathum Thani Hospital in Pathum Thani Province, Thailand. Simple random sampling was used to select participants to the experimental group (*n* = 30). The participants took part in the physical exercise promotion program consisting of 2 activities. The first activity, *Know Risks - Know Dangers - Prevent Falls*, comprised watching a video regarding falls in the elderly, group discussions, media lectures, and demonstrations and practices of a 10-step physical exercise to strengthen leg muscles. The second activity involved the use of intelligent postcard innovation to prevent falls as well as releasing emotions and feelings. The comparison group received activities determined by the hospital with a monthly follow-up for 3 months. A questionnaire and a leg muscle strength test were used as instruments in this study. Data were collected both before and after participating in the program and subsequently analyzed using descriptive statistics, paired t-test and independent t-test. The results showed that after participating in the program, the experimental group had higher mean scores for physical exercise to prevent falls and strengthening leg muscles than before participating in the program and those in the control group at α .05 significance level. This study concluded that the program developed from the protection motivation theory proposes that people protect themselves based on four factors. The researchers can effectively promote physical exercise to strengthen leg muscles in preventing falls of the elderlies.

Keywords: Elderly, leg muscle strength, physical exercise to prevent falls.

1. Introduction

At present, the proportion of elderly people in the population is gradually increased continually, from 13% in 2015 to 32.1% in 2016, while labor force population ratio tends to decrease [1]. Such rapid change in Thailand's population structure causes Thai society to be elderly society since 2005 with 10% elderly population ratio increase [2] based on surveyed data, 11.6% of elderly people have suffered from accidental falls, 6 months prior to interview [3]. In 2010, national mortality rate by falls is 5.89% of 100,000 population and has tendency to be increased to 10.03% in 2014. Such injuries lead to disability or death of elderly people [4].

The major causes of fall-related self-efficacy in older persons were such as vision blur, body balance, lag of physical exercises, their congenital disease, and medicine treatment [5] along with environment condition factor, such as wet floor & stairs, different floor level or uneven floor, insufficient light, no handrail in house (stairs and restroom). Currently, guidelines for preventing falls focus on elderly people and environmental conditions. The most effective prevention from falls is to strengthen physical conditions of elderlies [6]. The study has proposed 10 physical exercise postures, with a focus for strengthening leg muscle [7, 8]. Aims of physical exercise are to increase body movement efficiency i.e. leg muscle and joints. Therefore, elderly people should practice 5-15 minutes every day [9].

From literature review, it is found that factors affecting elderly falls prevention is bio-social factors such as gender, age, status, occupation, fall records [10] and incentive factors i.e. perceived severity of falls, perceived vulnerability to falls, expectation of response efficacy, expectation of self-efficacy, and physical intention [8]. These factors are classified under Pro-

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tection Motivation Theory. It can be explained that any protection motivation of people were based on 4 factors; perceived vulnerability of disease, perceived severity of disease, expectation of response efficacy, expectation of self-efficacy. Such perception will re-flex to changing of attitude and behavior of people [11].

According to the study in Thailand, it is found that relationship between such perceptions (perceived vul-nerability of disease, perceived severity of disease, expectation of response efficacy, expectation of self-efficacy) and elderly people's behavior on preventing falls in community and several preventing falls pro-gram for elderly people are provided. But elderly peo-ple fall can be found from concept of protection and motivation, that has influenced on preventing behav-ior. Therefore, the elderly to be fear of threat and lead to falls protection behavior [12]. From above litera-ture review, researchers are interested in development of physical exercise promotion program for enhance-ment of leg muscle strength that can prevent elderly people's falls.

2. Objectives

2.1 Main objective

To study on effectiveness of physical exercise promotion program for enhancement of leg muscle strength that can prevent elderly people's falls

2.2 Specific objectives

2.2.1 To compare average scores of experiment group on perceived vulnerability to fall down, per-ceived severity(damage) from accidental falls, expec-tation of response efficacy, expectation of self-efficacy, physical exercise intention for falling prevention, and leg muscle strength between pre and post experiment.
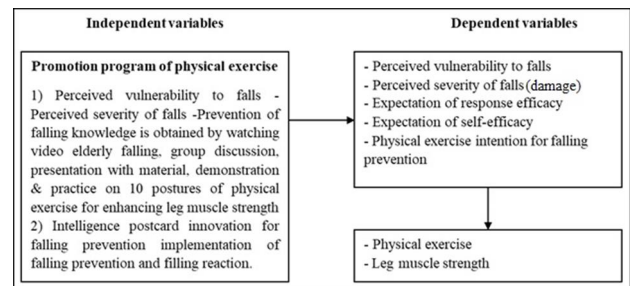
2.2.2 To compare average score of experiment group and control group on perceived vulnerability to falls, perceived severity to falls, expectation of re-sponse efficacy, expectation of self-efficacy, physical exercise intention for falling prevention, and leg mus-cle strength between pre and post experiment.

3. Hypothesis

3.1 Post-experiment, experiment group average scores on perceived vulnerability to falls, perceived severity to falls, expectation of response efficacy, ex-pectation of self-efficacy, physical exercise intention for falling prevention, and leg muscle strength is higher than pre-experiment.

3.2 Post-experiment, experiment group average score on perceived vulnerability to falls, perceived severity to falls, expectation of response efficacy, ex-pectation of self-efficacy, physical exercise intention for falling prevention, and leg muscle strength is higher than control group's average score.

4. Conceptual Framework

5. Research Methodology

A quasi-experimental research method was applied for this research with two groups: pre & post - test design. An appropriate sample size for this method should be 30 participants according to principle of Polit and Hunger [12]. Participants' age was 60 years or more. A simple random sampling was applied for selection of 60 participants and then they were di-vided into two groups: experimental group and control group with 30 participants each.

5.1 Selection criteria

In general, participants' age was 60 years or more. Moreover, they were patients of Pathum Thani Hos-pital, Pathum Thani Province and could participate in the whole program. In addition, all participants were able to communicate and understand Thai language.

Disqualified criteria were elderly patients who par-ticipated in specific falls prevention program besides normal program of hospital or had severe underlying disease e.g. cancer, heart disease, and stroke.

5.2 Promotion program on physical exercise in pre-venting falls for elderly people

Two activities of promotion program on physical exercise in preventing falls for elderly people; 1) per-ception on vulnerability and severity of falling by watching video of elderly people falls, group discus-sion, presentation with material, demonstration and operation on ten (10) postures of physical exercise for enhancing leg muscle strength; 2) dissemination on utilization of Intelligence postcard innovation for falling prevention implementation and feedback from elderly, are provided to experiment group.

The first activity started from providing consulta-tion to elderly people by research team about steps of participation in promotion program on physical exercise in preventing falls for elderly people. Af-ter that elderly people practiced on perceived vul-nerability, severity, and preventing of falling. This activity was implemented by video presentation on

Table 1. Comparing average scores of experimental group and control group both pre-experiment and post-experiment.

Variables	Pre-experiment		Post-experiment		t	p-value
	$\bar{x}$	S.D.	$\bar{x}$	S.D.		
Perceived vulnerability to falls						
Experimental group	3.31	0.43	4.14	0.50	-14.966	.000*
Control group	3.32	0.50	3.35	0.51	-.682	.501
Perceived severity of falls						
Experimental group	3.40	0.49	4.25	0.52	-15.378	.000*
Control group	3.45	0.40	3.59	0.55	-1.570	.127
Expectation of response efficacy						
Experimental group	3.35	0.45	4.22	0.58	-17.170	.000*
Control group	3.48	0.56	3.44	0.53	-.694	.493
Expectation of self-efficacy						
Experimental group	3.32	0.37	3.99	0.48	-11.514	.000*
Control group	3.17	0.58	3.20	0.55	-.551	.586
Physical exercise intention for falls prevention						
Experimental group	3.39	0.41	4.19	0.59	-13.511	.000*
Control group	3.33	0.53	3.40	0.54	-1.201	.240
Physical exercise in preventing falls						
Experimental group	3.29	0.50	3.70	0.72	-6.498	.000*
Control group	3.08	0.64	3.16	0.66	-1.624	.115
Leg muscle strength						
Experimental group	17.63	5.74	20.03	5.75	-7.180	.000*
Control group	16.53	5.22	16.93	5.32	-1.618	.117

*P<.05

falling of elderly people following by group discussion on "Causes of elderly people falls and its impact". After that presentation together with material on physical exercise for enhancing leg muscle strength for preventing elderly people falls was administered. Demonstration on ten (10) postures was provided by research team and the elderly people practices under supervision of research team.

The second activity, intelligence postcard innovation for falling prevention was implemented including feedback from participants. Such innovation consists of HP REVEL application that was used to scan picture in poster to obtain video presentation on ten (10) posture of physical exercise. This application was developed by Maj. Dr. Nattakritta Siri-Sophon. After that elderly people or participants had to make completely practices. Each posture, a signature and phone number of witness had to be put in monitoring form in postcard. Then added line group application in smart phone according to line ID or QR code in postcard for monitoring and information provision. For feedback from participants, elderly people explained feeling of self-efficacy to complete the exercise and expected results by practicing this activity.

5.3 Tools of data collection

The tool used for data collection in the present study was questionnaire, consisting of 8 parts as: 1) Personnel record of elderly people; 2) Perceived vulnerability to accidental falls; 3) Perceived severity (dam-age) from accidental falls; 4) Expectation of response efficacy; 5) Expectation of self-efficacy; 6) Physical exercise intention to prevent falls; 7) Physical exercise in preventing falls; 8) Measurement of leg muscle strength. This research tool was verified by three experts on content validity and index of item objective congruence (IOC) as shown in figure 0.60-1.00. In addition, Cronbach Alpha Coefficient was calculated for reliability as: 0.84, 0.90, 0.82, 0.84, 0.80, and 0.86 respectively. Regarding leg muscle strength, it was measured by using 30 second chair - stand test method along with supervision by physical therapist. The data were interpreted by applying criteria on ability test of leg muscle strength of male & female elderly people of Thai Health Promotion Foundation and Mahidol University [9].

5.4 Data analysis

5.4.1 General data were analyzed by using descriptive statistic, frequency distribution presented in term of percentage, mean, and standard deviation.

5.4.2 Comparing a difference of average score between pre and post experiment of experiment group by applying of paired t-test technique.

5.4.3 Comparing a difference of average score between experiment group and control group in stage of pre and post experiment was conducted by applying independent t-test technique on parameter of perceived vulnerability to falls, perceived severity of falls, perceived response efficacy, perceived self-efficacy,

Table 2. Comparing average score of experimental group and control group both pre-experiment and post-experiment.

Variables	Experiment group		Control group		t	p-value
	$\bar{x}$	S.D.	$\bar{x}$	S.D.		
Perceived vulnerability to falls						
Pre-experiment	3.31	0.43	3.32	0.50	.068	.946
Post-experiment	4.14	0.50	3.35	0.51	-6.022	.000*
Perceived severity of falls						
Pre-experiment	3.40	0.49	3.45	0.40	.428	.670
Post-experiment	4.25	0.52	3.59	0.55	-4.787	.000*
Expectation of response efficacy						
Pre-experiment	3.35	0.45	3.48	0.56	.938	.352
Post-experiment	4.22	0.58	3.44	0.53	-5.408	.000*
Expectation of self-efficacy						
Pre-experiment	3.32	0.37	3.17	0.58	-1.181	.242
Post-experiment	3.99	0.48	3.20	0.55	-5.910	.000*
Physical exercise intention for falls prevention						
Pre-experiment	3.39	0.41	3.33	0.53	-.470	.640
Post-experiment	4.19	0.59	3.40	0.54	-5.298	.000*
Physical exercise in preventing falls						
Pre-experiment	3.29	0.50	3.08	0.64	-1.399	.167
Post-experiment	3.70	0.72	3.16	0.66	-2.975	.004*
Leg muscle strength						
Pre-experiment	17.63	5.74	16.53	5.22	-.776	.441
Post-experiment	20.03	5.75	16.93	5.32	-2.166	.034*

*P<.05

physical exercise intention, physical exercise in preventing falls, leg muscle strength.

6. Results

Data on bio-society characteristic of experiment group and control group, most of them were female aged between 60-65 years, marital status, unemployment, and never fall within 6 months prior participation.

Results of comparing average score of pre and post experiment between experiment group and control group showed that the experimental group has average score of perceived vulnerability to falls, perceived severity of falls, perceived response efficacy, perceived self-efficacy, physical exercise intention, physical exercise in preventing falls, leg muscle strength are higher than prior experiment at significant level of 0.05. But control group's average score is not different between pre and post experiment (Table 1).

Results of comparing average scores of pre and post experiment between experimental group and control group showed that the post implementation the experiment group has average score of perceived vulnerability to falls, perceived severity of falls, perceived response efficacy, perceived self-efficacy, physical exercise intention, physical exercise in preventing falls, leg muscle strength are higher than control group at significant level of 0.05. But control group's average

score is not different between pre and post experiment (Table 2)

7. Conclusions and Discussions

The results of research on effectiveness of physical exercise promotion program for enhancement of leg muscle strength to prevent elderly people's falls found that physical exercise promotion program is important for enhancing leg muscle strength. This will help to prevent elderly people from accidental falls. The result indicated increasing average score of perceived vulnerability to accidental falls, perceived severity (damage) of falls, perceived response efficacy, perceived self-efficacy, physical exercise intention, and physical exercise in preventing falls, leg muscle strength after comparing with pre- experiment and control group at significant level of 0.05. That complies with study of Sirisopon [7] and Chanjirawadee et al. [14]. Because experimental group provided promotion program for physical exercise which has provided development mechanism on perceived vulnerability to accidental falls, perceived severity (damage)of falls, perceived response efficacy, perceived self-efficacy, physical exercise intention, physical exercise in preventing falls and to strengthen leg muscle. The participants were required to watch video of falling of elderly people and group discussion on "Cause of elderly people falls and its impact". Following by presentation together with material on physi-

cal exercise for enhancing leg muscle strength for preventing elderly people from accidental falls. Demonstration on ten (10) postures was conducted. Moreover, intelligence postcard innovation for falling prevention implementation and feeling from elderly was added and they can exchange knowledge and experience among their group. These activities made them aware of the severe effects. It resulted that their need for practices. These activities support physical exercise behavior for preventing fall according to the theory of incentive on disease prevention. It can be explained that perception of elderly people increases fear and insecurity. These factors lead to behavior changer for preventing falls [12]. If elderly people do physical exercise frequently, their leg muscle will be strengthened to assist elderly people from falls. While control group obtained normal program of hospital such as knowledge on preventing falls and leaflet, it was insufficient for incentive to practice or perform physical exercise.

In conclusion, the program which was developed by researcher can encourage physical exercise behavior of elderly people for enhancing leg muscle strength to prevent falls. The results of promotion program on physical exercise has an influence on elderly people's intention to exercise their legs for preventing fall in the future.

8. Recommendations

8.1 The physical exercise promotion program results change behavior of elderly people to exercise for preventing falls and enhances their leg muscle strength. So, this promotion program should be applied for other elderly groups.

8.2 Study and development of pattern for behavior promotion should be conducted systematically by applying theory of incentive for disease prevention and theory of social support for changing elderly people's behavior to prevent falls because the individual's social relationships have a high influence on expectations and reactions to support [14].

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