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The Development of Physical Activity Model to Enhance Physical Fitness of the Elderly with Dementia in Udon Thani Province

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ABSTRACT

Sukdee N, Sumnuan P, Yapapha S, Prasantree P, Kaewma J, Tongterm T. The Development of Physical Activity Model to Enhance Physical Fitness of the Elderly with Dementia in Udon Thani Province. **JEPonline** 2023;26(4) :104-116. The purpose of this study was to examine the development and efficiency of a physical activity model to enhance the physical fitness in the elderly with dementia in Udon Thani province, Thailand. A purposive sampling method included 50 people who were 60 to 74 years of age. The research instruments were the physical activity model to enhance the physical fitness of the elderly with dementia, a questionnaire, a structured interview form, a senior fitness test, a Thai mini-mental state examination, and the physical activity readiness questionnaire. The physical activity model was applied to the Experimental Group for 8 weeks, with 3 weekly sessions of 60 min each. They were tested before the intervention, after 4 weeks, and after 8 weeks. A one-way repeated-measures ANOVA and paired sample *t*-tests were used to compare physical fitness at pre-test, after 4 weeks,

and after 8 weeks, resulting in a 95% confidence interval. The results showed that the physical activity model developed comprised concepts and theories, objectives (9 activities), physical fitness evaluation with an Index of Item Objective Congruence (IOC) of 0.96, and the improved physical fitness of the Experimental Group after 4 and 8 weeks compared to before. Statistical significance was set at the .05 level. This model can encourage the elderly with dementia to perform regular physical activity to result in better physical performance and to delay the deterioration of various systems in the body.

Key Words: Elderly, Dementia, Physical Activity Model, Physical Fitness

INTRODUCTION

A 2016 Survey (20) indicated that there has been a change in the elderly population in Thailand. It was reported that the percent of the elderly population 60 years of age and over has increased to 10% of the total population. Also, it is estimated that by 2035, the elderly population will triple or be more than 10% of the entire country's population. Specifically, in Udon Thani Province, there was a population survey on people aged 60 years and older, including 237,408 people (108,333 males, 129,075 females). The statistical figures show that Udon Thani Province has stepped into an “Aging Society” and it is predicted that by 2025, Udon Thani Province will have an elderly population of 19.61% and will be a complete aging society in the future. (22)

Given this expectation, it is important that the elderly population is prepared for a quality entry into the elderly way of life. This means the encouragement of health and quality of life is for living that will have a positive influence on their physical, mental, emotional, and social happiness. In particular, the elderly must develop a strong state of physical health that will help to ensure the existence of the mind and body without various diseases, including chronic non-communicable diseases that may occur from the lack of continuous exercise. Also, failing to exercise on a regular basis increases the likelihood of dementia, which is another disease condition with a higher incidence rate in the elderly.

According to statistics released by the Ministry of Interior in 2016, Thailand had a population of over 9.9 million people aged 60 years and older, which represents 15% of the total population of 65.9 million. In the aging society, the problem that follows is dementia. It is also much more common than in other age groups. According to a survey by the Institute of Health Systems Research using the latest physical examination in 2014, it was found that the elderly aged 60 years and older with dementia accounted for 8.1%, which is estimated to be approximately 800,000 elderly people in the country, and it is more often found in the elderly females more so than in elderly males (6). People with dementia have deterioration of brain capacity in many areas due to abnormal functioning of certain parts of the brain, resulting in forgetfulness of things that have been done or that have been seen recently. There is also the decrease in cognitive abilities, the inability to think and remember things in the present, and the loss of memory and concentration.

The type of dementia that can be cured is often caused by the lack of exercise and insufficient physical activity, including physical disease resulting in narrowing of the blood vessels (Vascular Dementia) in an area of the brain caused by fat and blood sugar levels that

are higher than normal. Therefore, it is imperative to find ways to prevent and to solve health problems in the elderly to achieve good physical fitness and readiness in all dimensions for this age change (5).

A physical activity model is another method of health care, and it is the primary care of the elderly with dementia. It can help the body move freely while having a positive influence on the circulation of blood to nourish the vital parts of the body, especially the brain. Regular physical activity and exercise will also help the body develop immunity against various ailments and prevent disability caused by the lack of exercise or insufficient physical activity. Also, the right dose of physical activity can help the body recover from injuries and ailments.

The study by Feter et al. (7) focused on late-life physical activity with dementia risk. The results showed that at baseline, 69% of the patients were classified into the medium, low, and high category inactive or underactive groups. The incidence of dementia was 4.8%, 0.9%, and 0.2%, respectively. In the analysis of patients with low and moderate physical activity, the risk was 60% and 78%, respectively, lower than that in the inactive group.

Regarding the number of patients over the age of 50 with the incidence of dementia summarized by research results, there was an inverse relationship between physical activity and the onset of dementia for more than 15 years, even at low levels of physical activity. Groot et al. (9) studied the effect of physical activity on brain function in patients with dementia. A meta-analysis of randomized controlled trials found that physical activity was beneficial in patients with Alzheimer's. Exercise has a positive effect on patients with functional dementia.

Chumbuathong et al. (4) studied the effect of aerobic exercise on reflexes and memory in the elderly. Right hand, left hand, and left foot reflexes were better in the Experimental Group than that in the Control Group, as well as computational scores, language, and total memory scores. It was found that the Experimental Group had significantly higher values than the Control Group ($P < 0.001$). In addition, Kraithep et al. (12) studied exercise and the reduction of dementia risk factors among elderly women. The results showed that the Exercise Group reduced dementia risk factors. Compared to the Non-Exercise Group, the risk of dementia was 4.75 times higher, the risk of hypertension was 2.18 times higher, and the risk of diabetes was 3.23 times higher in the group with physical inactivity. Hence, it is important to encourage exercise in the elderly.

Chen et al. (3) studied aerobic and resistance exercise programs for improving mobility in the chronically ill elderly in Taiwan. The results showed that the benefits of general aerobic exercise and resistance training could increase the mobility of the elderly who are chronically ill. They reported that either aerobic exercise or resistance exercise, or a combination of both improved the mobility and posture of the chronically ill elderly and prevented falls. However, there are currently no specific research studies on developing a physical activity model to enhance the physical fitness of the elderly with dementia. Clearly, elderly individuals should be encouraged to engage in regular physical activity to increase their strength and ability to perform daily tasks. It can also help to save on medical expenses from diseases caused by lack of physical activity and inadequate exercise. Thus, it reduces the burden of dependence on people around them, and an elderly person who has a healthy physical, mental,

intellectual, emotional, and social life is safe from various diseases and is a driving force in the nation's further development.

The purpose of this study was to develop a physical activity model to enhance the physical fitness of the elderly with dementia, and evaluate the effectiveness of the physical activity model in enhancing the physical fitness of the elderly with dementia. This study emphasizes the importance of developing a physical activity model to enhance the physical fitness of the elderly with dementia in Udon Thani Province, a province with the highest number of elderly people in Thailand. The elderly in Udon Thani will have the opportunity to participate in physical activities sufficient and suitable for their physical condition and the context of the daily life of the elderly in the community, including being able to apply physical activities on their own until it becomes a daily routine. This will help the elderly in communities in Udon Thani have better health and carry out daily life activities.

METHODS

Subjects

The sample groups used in this study were 50 elderly people with dementia in the Udon Thani Province, Thailand. There were 18 males and 32 females with a mean age of 66.04 ± 2.82 years, a mean height of 159.74 ± 5.75 cm, and a mean weight of 57.20 ± 9.38 kg. The sample was obtained by purposive sampling using inclusion criteria, i.e., old age and dementia. Those within the age range of 60 to 74 years who: (a) passed the initial brain examination performed by medical personnel using the Thai Mini-Mental State Examination (MMSE-Thai 2002); (b) had a test score of less than 17; and (c) were diagnosed by a medical professional as able to engage in physical activity and exercise were included. Hence, an eligible participant was a person without a serious underlying disease, without nervous system problems affecting movement, communication, vision, and hearing, and without psychiatric disorders. Also, the elderly person must voluntarily participate in this research. There were exclusion criteria, i.e., a diagnosis from a medical professional that it was prohibited to exercise, presence of severe congenital disease problems such as brain disease, stroke, nervous system diseases, heart disease, diabetes, physical disabilities affecting movement, inability to communicate, see, and hear normally, and other psychiatric disorders. This research received ethical considerations from the Ethics Committee of the National Sports University (EDU 001-2565).

Procedures

This study aimed to develop a physical activity model to enhance the physical fitness of the elderly with dementia in Udon Thani Province. There were three phases of the research process, as follows:

Phase 1: Study concept, theories, and physical fitness problems in the elderly with dementia in Udon Thani Province. The researcher proceeded with the following "5 steps": ***Step 1***, it was important to research information about the problems in physical activity and physical performance of the elderly with dementia. This information came from academic articles, books, textbooks, and related research. ***Step 2***, medical information specific to dementia in elderly individuals was studied as it pertained to physical activity affecting dementia, as well as the principles of physical activity, and the limitations of the elderly with dementia from

academic articles, books, textbooks, and related research. ***Step 3***, a research questionnaire on the physical activities of the elderly in Udon Thani Province was developed, including a Structured Interview Form to better understand the potential for problems, and the necessity of the physical activity model to enhance the physical fitness of elderly with dementia in Udon Thani Province. ***Step 4***, the questionnaire was made available to the elderly in Udon Thani province. Only the questionnaires that the respondents answered completely were used to structure the interview form to interview relevant stakeholders and elderly with dementia in Udon Thani Province. The in-depth interview included 30 people: 3 elderly people, 3 elderly caregivers, 3 physiotherapists, 1 physician, 4 elderly nurses, 3 public health professionals, 6 physical education teachers, and 7 sports scientists. There were 12 focus groups consisting of 3 physical education teachers, 4 sports scientists, 2 elderly nurses, 2 elderly caregivers, and 1 elderly person. ***Step 5***, the information obtained from the study of concepts, theories, and content from academic textbooks, journals, and related research, in-depth interviews, and focus group discussions, summarizing the study results regarding the concepts, theories, problems, and the need for the physical activity model in the elderly with dementia in Udon Thani Province.

Phase 2: The development of the physical activity model to enhance the physical fitness of the elderly with dementia in Udon Thani Province. following “4 steps”: ***Step 1,*** the results of Phase 1 were used to analyze, synthesize, and form physical activities to encourage physical fitness in the elderly with dementia in Udon Thani Province. ***Step 2,*** *a*pplied a physical activity model that the researcher developed to enhance the physical fitness of the elderly with dementia in Udon Thani Province. For quality assessment, content validity (IOC: Index of Item Objective Congruence) was checked by 5 experts with expertise in physical education, sports science, and the elderly. ***Step 3***, brought suggestions from experts for improvement and correction to obtain a physical activity model to enhance the physical fitness of the elderly with dementia in Udon Thani Province. ***Step 4***, applied the physical activity model developed on a group of 30 people of similar characteristics for trial.

Phase 3: Regarding the physical activity model trial to enhance the physical fitness of elderly with dementia in Udon Thani Province, the researcher proceeded with the following steps: ***Step 1***, assessed dementia in the elderly using Mini-Mental State Examination; MMSE-Thai 2002 (10). ***Step 2,*** assessed the participants’ readiness before participating in physical activities using the Physical Activity Readiness Questionnaire (PAR-Q). ***Step 3***, try out the physical fitness of the participants before the trial by using the physical fitness test of the elderly (11,19,21), including muscle strength using Arm Curl test, Muscular endurance using the 30-second Chair Stand Test, respiratory and circulatory endurance using the 2-minute Step Test, flexibility using the Chair Sit-and-Reach Test, body composition using Body Mass Index, and balance and agility using the 8-feet Up-and-Go Test. ***Step 4***, conducted a physical activity model trial to enhance the physical fitness of the elderly with dementia in Udon Thani Province. According to the trial plan developed by the researcher, it consisted of 9 activities: 1) walking on a line; 2) walking with the swinging of hands; 3) activities with nine squares; 4) aerobic dance activities; 5) dancing activities; 6) stretching activities; 7) exercise with body weight; 8) exercise with an elastic band; 9) yoga activity with 3 steps: (a) warm-up, (b) physical activity, and (c) cool down, for a duration of 8 weeks, 3 times a week, 60 minutes each (Tuesday, Thursday, and Saturday). ***Step 5***, test the physical fitness of the samples after 4 weeks and 8 weeks after the trial with the Elderly Physical Fitness Test. ***Step 6***, the

physical fitness test results of the participants were used for statistical analysis and summary of the trial results and suggestions.

Research Instruments

1. The Instrument Used in the Research

The research instrument was a physical activity model to enhance the physical fitness of the elderly with dementia in Udon Thani Province, which was developed by the researcher and passed the examination for content validity by 5 qualified people with expertise in physical education, sports science, and the elderly. It was found that the IOC was 0.96 and the suggestions received were applied to a group of 30 people of similar characteristics for trial to improve physical fitness.

2. The Instruments Used to Collect Data

The instruments used for data collection were: (a) questionnaire on physical activities of the elderly in Udon Thani Province, and structured interview form that has been assessed for the quality of the tool, which was checked for content validity by five experts; it was found that the IOC was between 0.5-1.00; (b) Elderly Dementia Assessment Form using Thai Mini-Mental State Examination (TMSE); (c). PAR-Q; and (d). Physical fitness test of the elderly person

Statistical Analyses

The data were analyzed and the information was obtained for the study with respect to principles, theories, and content related to the elderly, dementia, physical activity that affects dementia, principles of the physical activity, and potentials and limitations of the elderly with dementia, including data from in-depth interviews with the elderly and elderly caregivers, sports scientists, physical education teachers, physiotherapists, doctors, nurses, public health workers, and others involved (Stakeholder) with the elderly in Udon Thani Province. Descriptive statistics was used to analyze basic data and physical fitness tests in the sample group, and then the data were represented as mean and standard deviation. The variables from the Physical Fitness Test were compared with respect to the participants before the trial, after 4 weeks of the trial, and after 8 weeks of the trial by testing normal curve distribution using the Shapiro-Wilk Statistics Test. Then, the differences in physical fitness of the participants were analyzed. The results obtained before, 4 weeks after, and 8 weeks after the trial were analyzed using a One-Way Repeated-Measures Analysis of Variance. The mean score difference was tested in pairs using the Bonferroni Method with the significance set at a .05 level.

RESULTS

The researcher developed a physical activity model to enhance the physical fitness of the elderly with dementia in Udon Thani Province based on the elderly, dementia, physical activity that affects dementia, principles of the physical activity, and potentials and limitations of the elderly with dementia. There were four main components: 1. Concepts and theories; 2. Objectives; 3. Physical activity procedures; and 4. Measuring and evaluating physical fitness, which consisted of 9 activities as follows: 1) walking on a line; 2) walking with the swinging of hands; 3) activities with nine squares; 4) aerobic dance activities 5) dancing activities; 6) stretching activities; 7) exercise with body weight; 8) exercise with an elastic band; 9) yoga

activity with 3 steps: 1. Warm-up, 2. Physical activity, and 3. Cool down for a duration of 8 weeks, 3 times·wk^{-1}, a total of 24 times, 60 minutes each. Physical fitness of the elderly with dementia in Udon Thani Province has gone through the quality process by checking the content validity. It was found that the content was consistent with what has been studied. IOC was 0.96, revised according to expert recommendations, and tried out with a group of 30 people with similar characteristics.

The Physical Fitness Test results of the participants were taken before the trial, after 4 weeks, and after 8 weeks of the trial to analyze and present the data in the form of a Table. The details are as follows: **(a)** Physical performance regarding muscle strength was better 4 weeks and 8 weeks after the trial than before the trial and was better 8 weeks after the trial than 4 weeks after. There was a statistically significant difference at the .05 level. **(b)** Physical performance regarding muscular endurance was better 4 weeks and 8 weeks after the trial than before the trial and was better 8 weeks after the trial than 4 weeks after. There was a statistically significant difference at the .05 level. **(c)** The physical performance regarding cardiovascular endurance was better 4 weeks and 8 weeks after the trial than before the trial and was better 8 weeks after the trial than 4 weeks after. There was a statistically significant difference at the .05 level. **(d)** Physical fitness regarding flexibility was better 4 weeks and 8 weeks after the trial than before the trial and was better 8 weeks after the trial than 4 weeks after. There was a statistically significant difference at the .05 level. **(e)** Physical fitness regarding body composition was lower 4 weeks and 8 weeks after the trial than before the trial and was lower 8 weeks after the trial than 4 weeks after. There was a statistically significant difference at the .05 level. **(f)** Physical performance regarding balance and agility was lower 4 weeks and 8 weeks after the trial than before the trial and was lower 8 weeks after the trial than 4 weeks after. There was a statistically significant difference at the 0.05 level. (Table 1).

Table 1. Mean, Standard Deviation, and the Results of the One-Way Repeated Measures Analysis of Variance (n = 50).

Variables	Mean)± SD(	P
Muscle Strength		
Before the trial	10.68 (± 2.85)	0.00
After 4 weeks of the trail	13.34 (± 3.23) *	
After 8 weeks of the trail	17.06 (± 2.98) *	
Muscular Endurance		
Before the trial	9.60 (± 2.73)	0.00
After 4 weeks of the trail	12.64 (± 2.74) *	
After 8 weeks of the trail	15.34 (± 2.73) *	
Cardiovascular Endurance		
Before the trial	71.28 (± 8.61)	0.00
After 4 weeks of the trail	76.61 (± 8.90) *	
After 8 weeks of the trail	79.72 (± 8.95) *	

Flexibility		
Before the trial	-1.48 (± .99)	0.00
After 4 weeks of the trail	-1.30 (± 1.02) *	
After 8 weeks of the trail	-1.02 (± 1.08) *	
Body Composition		
Before the trial	22.32 (± 2.39)	
After 4 weeks of the trail	21.74 (± 2.34)	0.00
After 8 weeks of the trail	21.38 (± 2.26)	
Balance and Agility		
Before the trial	6.38 (± .74)	
After 4 weeks of the trail	6.45 (± .75)	0.00
After 8 weeks of the trail	6.15 (± .71)	

*Significant difference when compared with before the trail at $P < 0.05$

DISCUSSION

The Development of a Physical Activity Model to Enhance the Physical Fitness of the Elderly with Dementia in Udon Thani Province

The researcher developed the physical activity model to enhance the physical fitness of the elderly with dementia in Udon Thani Province using the concepts and theories related to the elderly, dementia, physical activity that affects dementia, principles of the physical activity, and potentials and limitations of the elderly with dementia. The model has undergone the process of quality checking and can be used for physical activity to enhance the physical fitness of the elderly with dementia. The physical activity model developed is an exercise activity that enhances physical fitness, slows down the deterioration of the brain, promotes the function of the nervous system and muscles, and increases brain-derived neurotrophic factor (BDNF) in the elderly with dementia by adhering to the principles of physical activity and exercise.

The principles of practice consist of 6 steps: First, analyze the basic health information of the elderly with dementia. Second, assess movement and related physical fitness before exercising. Third, determine systematic exercise guidelines. Fourth, choose a form of physical activity. Fifth, choose an exercise position or activity. Sixth, set the training amount, intensity, duration, and frequency. Physical activities start with a mild exercise to moderate and not too hard by focusing on the consistency of body movement, development of physical fitness, and brain function.

Regular physical activity will help the elderly to achieve good health and better working conditions of various systems in the body, reduce excess body fat, reduce the occurrence, slow down the deterioration of the body and various organs, and prevent various diseases that are caused by insufficient physical activity, such as hypertension, diabetes, stroke, cardiovascular and cerebrovascular diseases, and obesity, resulting in the elderly living their daily life happily and independently. It can help reduce family health expenses as well. This is consistent with a study by Zeng et al. (23), which focused on the effect of physical activity

training on dementia patients: systematic data collection. The results suggested that the effects of physical activity can increase time, body function, pace per minute, self-care, and improved balance.

A study by Goncalve et al. (8) focused on the effects of physical activity on people with dementia. The results indicated that physical activity is important for patients with dementia. This is because it has many positive effects on health outcomes for both patients and caregivers. Lewis et al. (14) reported a study on exercise and dementia and found reliable evidence for health enhancement. Cognitive benefits are combined with psychological benefits and behavioral limitations. Overall, exercise can enhance the physical and mental health of people with dementia. There is sufficient evidence to recommend a variety of exercises.

In addition, Zhou et al. (24) examined the relationship between physical activity and dementia risk, which was a nationwide longitudinal study in China. The results showed that people who exercised regularly had less dementia risk than those who never exercised. This suggests that regular exercise is associated with a reduced risk of dementia. Park and Cheon (16) reported on a 16-week study of the effects of combination exercise on dementia, depression, and brain function in older females. It was found that regular and continuous combination of exercise had decreased dementia modulation effect and affected depression and brain function. Alty et al. (1) studied exercise and dementia prevention and reported that age factors, genetics, and lifestyle contributed to Alzheimer's and other dementias. About 1 in 3 people with dementia are at risk of not exercising and smoking, while having high blood pressure. With the increasing prevalence of dementia, exercise is an important intervention in influencing positive cognition, including a decline in the incidence of dementia in the elderly.

The Effectiveness of a Physical Activity Model to Enhance Physical Fitness of the Elderly with Dementia in Udon Thani Province

By participating in a physical activity model to enhance the physical fitness of the elderly with dementia in Udon Thani province, it was found that the physical fitness of the elderly with dementia in Udon Thani was improved 4 weeks and 8 weeks after the trial than before the trial and was improved 8 weeks after the trial than 4 weeks after. There was a statistically significant difference at the .05 level. Participating in the physical activity model to enhance the physical fitness of the elderly with dementia in Udon Thani Province, we ensured proper body movements and exercises in accordance with scientific principles. The intensity of the activity, frequency, and duration were appropriate according to age, including the diverse physical activities that did not make the elderly feel bored. As a result, the elderly had better physical performance, were happy, had fun, and relieved themselves from stress after participating in the physical activity model organized by the researcher.

The present study is consistent with the study by Lamb et al. (13), which examined dementia and trials of moderate to vigorous physical activity in individuals with dementia. Interestingly, their results concluded that aerobic and strength-building exercise programs did not slow cognitive impairment in people with mild to moderate dementia. A study by Pitkala et al. (17) focused on the effects of exercise on mobility and function in older adults using a systematic review of relevant literature. It showed that intensive physical rehabilitation increased flexibility, and exposure to it for long periods may improve bodily functions in people with dementia. Lam et al. (13) studied exercise to increase muscle strength, balance, agility, and

endurance in individuals with cognitive impairment and dementia using a thorough review of the relevant research. The research results showed that people with different levels of intellectual disability benefit from a variety of supervised exercises, lasting for 60 minutes, 2 to 3 days a week, to improve physical function, and exercise helps to increase strength, balance, agility, and endurance in individuals with cognitive impairment and dementia. Pruksasri et al. (18) studied the effect of a dance program on balance among older adults at risk of falling. The results showed that the Experimental Group's body balances were statistically significantly higher at the .05 level than that in the Control Group. It suggested that a social dance exercise program improves balance and self-confidence in older adults. Each elderly person should use social exercise to enhance their rehabilitation and health.

In addition, Boonprasert et al.)2(studied the effects of Hatha yoga on physical fitness in the elderly. The results showed that Hatha yoga exercise could increase physical fitness in the flexibility of muscles and joints and the endurance of the lungs and heart in the elderly. Therefore, personnel caring for the elderly should encourage the elderly to participate in Hatha yoga exercises to improve their physical fitness. Norkham et al. (15) studied the effect of the step-by-step exercise on balance. The results showed that the balance of the elderly in the Experimental Group after the experiment was higher than before and significantly higher than that in the Control Group at the .001 level. The research showed that the step-by-step exercise improved the balance of the elderly. Therefore, the step-by-step exercise in the tables can be used as an alternative to exercising to develop the balance abilities of the elderly.

CONCLUSIONS

The physical activity model was developed to enhance the movement of all body parts in the elderly. It results in the activation of the brain, which controls Motor control, Sensory neurons, and Motor neurons, improving the work of various systems in the body of the elderly. It leads to strong physical performance, reduces excess body fat, reduces the risk of falls, slows down the deterioration of the body and organs, and prevents the occurrence of non-communicable diseases, such as hypertension, diabetes, cardiovascular and cerebrovascular diseases, dementia, and obesity, which are often caused by a lack of exercise and inadequate physical activity. In addition, having regular and appropriate physical activities for the elderly can improve the ability of the brain in cognitive function (memory, thinking, knowledge, decision-making, and planning), make the function of the brain still effective, and slow down the degeneration of the brain. Furthermore, participation in physical activities for the elderly leads to social interactions with the same peer, making the elderly to be happy, have fun, and have a better quality of life.

The physical activity model should be developed to enhance the physical fitness of the elderly in each group of chronic diseases such as hypertension, osteoarthritis, diabetes, obesity, etc. To help the elderly with limitations in each aspect, they can participate in physical activities suitable for them. There should also be education and development of physical activities that can enhance social skills, thinking skills, and planning skills to encourage the elderly to use their thoughts, slowing down dementia in the elderly.

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REFERENCES

1. Alty J, Farrow M, Lawler K. Exercise and dementia prevention. ***Pract Neurol.*** 2020; (20):234-240.

2. Boonprasert C, Panuthai P, Chintanawat R. Effect of hatha yoga exercise on physical fitness among older persons. ***Nurs J.*** 2016;(43):35-47. (In Thai)

3. Chen MS, Lin TC, Jiang BC. Aerobic and resistance exercise training program intervention for enhancing gait function in elderly and chronically ill Taiwanese patients. ***Public Health.*** 2015;(129):1114-1124.

4. Choombuathong A, Chaitiamwong R, Sanguansit P, Tothonglor A. Effect of aerobic exercise on reaction time and memory in the elderly. ***J Health Sci***. 2015;(24):283-295.

5. “Dementia” is most common in the elderly [Internet]. Thailand: Office of the Health Promotion Fund; ©2015 [cited 2020 Nov 20]. Available from www.thaihealth.or.th

6. Eight hundred thousand elderly with dementia in Thailand [Internet]. Thailand: Department of Mental Health; ©2018 [cited 2020 Nov 3]. Available from www.dmh.go.th/news-dmh/view.asp?id=27992.

7. Feter N, Mielke GI, Leite JS, Brown WJ, Coombes JS, Rombaldi AJ. Physical activity in later life and risk of dementia: Findings from a population-based cohort study. ***Exp Gerontol*****.** 2021;(143):111145.

8. Gonçalves AC, Marques A, Samuel D, Demain S. Outcomes of physical activity for people living with dementia: Qualitative study to inform a core outcome set. ***Physiotherapy.*** 2020;(108):129-139.

9. Kraitap P, Rudtanasudjatum K, Tadkatuk A, Khaokhiew T. Physical activity and reducing the risk factors for dementia among the aging female. ***J Health Sci.*** 2019; (28):650-659.

10. Institute of Geriatrics, Department of Medical Services, Ministry of Public Health. (2008). Medical Technology Evaluation Project: Comparison of the Thai Mini-Mental State Examination (MMSE-Thai) 2002 and the Thai Mini-Mental State Examination

(TMSE) in screening elderly people with dementia. Bangkok: CG Tool Company Limited.

11. Jones CJ, Rikli RE. Measuring functional. ***J Active Aging*****.** 2002;(1):24-30.

12. Kraitap P, Rudtanasudjatum K, Tadkatuk A, Khaokhiew T. Physical activity and reducing the risk factors for dementia among the aging female. ***J Health Sci.*** 2019; (28):650-659.

13. Lamb SE, Sheehan B, Atherton N, Nichols V, Collins H, Mistry D, et al. Dementia and physical activity (DAPA) trial of moderate to high intensity exercise training for people with dementia: Randomised controlled trial. ***BMJ***. 2018;(361):1675.

14. Lewis K, Livsey L, Naughton RJ, Burton K. Exercise and dementia: What should we be recommending? ***Qual Ageing.*** 2020;(27):109-127

15. Nokham R, Panuthai, Khampolsiri T. Effect of square-stepping exercise on balance among older persons. ***Nurs J*****.** 2016;(43):58-68. (In Thai)

16. Park CH, Cheon JU. Effects of 16-week combined exercise on dementia, depression, and cognitive function in elderly women. ***Korean J Appl Sci Technol*****.** 2019;(36):456-467.

17. Pitkälä K, Savikko N, Poysti M, Strandberg, Laakkonen ML. Efficacy of physical exercise intervention on mobility and physical functioning in older people with dementia: A systematic review. ***Exp Gerontol.*** 2013;(48):85-93.

18. Pruksasri P, Kongin W, Jittanoon P. The effects of social-dance exercise program on balance among the fall-risk elderly. ***Songklanagarind Med J.*** 2010;(26): 323-337.

19. Rikli RE, Jones CJ. Development and validation of a functional fitness test for community-residing older adults. ***J Aging Phys Act*****.** 1999;(7):129-161.

20. SITUATION OF THE THAI ELDERLY 2016 [Internet]. Thailand: Ministry of Social Development and Human Security; ©2017 [cited 2020 Nov 3]. Available from http://www.dop.go.th

21. Sport Science Bureau, Department of Physical Education. Ministry of Tourism and Sports, (2019).

22. Statistics of the Elderly in Thailand [Internet]. Thailand: Department of Older Persons, Ministry of Social Development and Human Security; ©2019 [cited 2020 Nov 20]. Available from http://www.dop.go.th

23. Zeng Z, Deng YH, Shuai T, Zhang H, Wang Y, Song GM. Effect of physical activity training on dementia patients: A systematic review with a meta-analysis. ***Chinese Nursing Res.*** 2016;(3):168-175.

24. Zhou Z, Fu J, Hong YA, Wang P, Fang Y. Association between exercise and the risk of dementia: Results from a nationwide longitudinal study in China. ***BMJ Open***. 2017;(7):017497.

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