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Research Article

EFFECTIVENESS OF A HEALTH PROMOTION PROGRAM USING THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION IN KLONGYONG AND NIKHOMPATTANA, THAILAND

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ABSTRACT

Objectives: This study aimed to establish a health-care program that adopted ISO9001:2008 (the International Organization for Standardization) in Thailand to improve problems and inspect its effectiveness. Furthermore, we make this health promotion of ISO widely available in Asian countries and make an international contribution.

Methods: We implemented a 9-month health program in the Klongyong, and a 6-month health program in Nikhompattana, Rayong, Thailand. This program assessed findings from pedometry, anthropometry, physical fitness, and brain function tests.

Results: In Klongyong, the average number of walking and exercise steps was 3471.3±129.1, and in Nikhompattana, the average number of walking and exercise steps was 4695.5±408.3. The pre- and post-health programs in Klongyong showed significant differences in blood pressure, hand grip strength, 10 m-obstacle walk, and 6-min walk, and in Nikhompattana, significant differences in the hand grip strength, sit and reach flexibility, and brain function test were observed. The pre- and post-health programs in Klongyong and Nikhompattana showed significant differences in a total number of miss times.

Conclusions: The findings from the before and after pre-and post-health programs in Nikhompattana suggest that the increased physical activity during the course of the program may have led to improved brain function results.

Keywords: Health promotion, Pedometer, Physical fitness, Brain function.

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INTRODUCTION

The World Health Organization has set the goal of "Primary Health Care" (PHC). PHC recognizes all people's health as a basic human right and guarantees subjective participation and self-determination rights in the process of achieving it [1]. This concept led to the health promotion of 1986 [2]. Health promotion is an important tool in preventing illness [3,4]. The Chuan Government's decentralization policy was instrumentally used by community health-oriented bureaucrats in pursuing legislation or the National Health Act, considered a concrete expression of the health promotion movement [5].

The number of elderly people around the world is expected to increase. In Thailand, the number of the elderly people aged over 65 years is increasing. The United Nations (UN) reported that an "aging society" is when >7% of the total population is 65 years old or over, and an "aged society" is when that number increases to >14%. The UN reported that Singapore and Thailand, countries of the Association of Southeast Asian Nations, are aging fast and the population 65 years old and over is projected to increase by more than 7 million in Singapore and more than 1 million in Thailand, from 2020 to 2025 [6].

It is important for health care to provide information, to share it, to cooperate with everyone, and to clarify the role sharing of counselors and coaches [7].

To achieve the elderly population's desired health and well-being, a thorough assessment of health and health behaviors would be the foundation for tailoring an effective plan. In social ecological models, interactions between community members and their environment are crucial. Assessments of the health and health behaviors are the foundation for tailoring a health promotion-prevention plan to a given client. The assessment provides the database for making clinical judgments regarding the client's health strengths, health problems, nursing diagnoses, and desired health or behavioral outcomes, as well as the interventions likely to be effective [8].

The health education curriculum in Thailand focuses on nutrition and exercise [9,10]. The health education curriculum developed for this study, which adopted ISO9001:2008 (the International Organization for Standardization), has been implemented by measuring energy expenditure and conducting brain function, physical fitness, and blood tests and providing educational seminars regarding exercise and nutrition and recreational activities, such as hiking and cooking [11-14]. The practice of health education in Thailand usually includes monthly meetings with club members and periodic seminars to develop participants' leadership through Thai yoga and stretch exercises; however, the absence of a systematic evaluation after initiation of the program was observed to make an evaluation of the effectiveness of such a health program difficult for the Thai health practitioners. This study aimed to establish our health-care program in Thailand by adopting ISO9001:2008, improving on its problems, and using its effectiveness to compare the health education of Klongyong and Nikhompattana in Thailand.

METHODS

General method

We implemented a 9-month health program from December 2014 to August 2015 in Klongyong, and a 6-month health program from August 2013 to January 2014 in the city of Nikhompattana, in Thailand. This program assessed findings from pedometry, anthropometry, physical fitness, and brain function tests. For the measurement and testing of this study, we first performed a blood test and then measured weight, height, and blood pressure. Second, we had participants perform the go/no-go task, which is a brain function measurement, and third, we performed physical fitness measurement by measuring hand grip strength, sit-ups, sit and reach flexibility, an eyes-open single-leg stance, and a 10-m obstacle walk. Finally, we measured the distance of a 6-min walk.

The study participants from Klongyong were 46 elderly participants aged 69.8±6.5 years, including 13 men aged 69.9±6.4 years and 33 women aged 69.7±6.7 years. The study participants from Nikhompattana were 114 elderly participants aged 60.5±11.1 years, including 31 men aged 66.3±7.1 years and 83 women aged 58.3±11.5 years. The participants were healthy elderly people from Klongyong and Nikhompattana, Thailand, who attended public health center program once a month and agreed to be participants in this study. Those who lost their health during this health education implementation period and were unable to come to the health center were excluded from the study.

In Klongyong and Nikhompattana, during this program, the participants received a series of seminars regarding recreational activities for 90 or 120 min once or twice per month. In addition, the subjects from Klongyong performed stretching and muscular training for 90 min once per week, and Nikhompattana performed aerobic exercises 3 times per week and at-home training every day (Table 1). Because the results of the brain function, physical fitness, body weight, and blood chemistry tests' values were significantly improved by the exercise of 7000 or more steps [11-14]. The latest guidelines based on the Helsinki Declaration were adopted by the Institutional Ethics Committee of Mahidol University (Mahidol Univ. ID: 01-58-10) and Shinshu University (UMIN000009309). Written informed consent was obtained from all the participants.

Pedometry

A pedometer measured the daily number of walking steps and amount of energy expenditure (Acos Co. Ltd., Japan; AM500NE) to count the daily and exercise steps. Exercise steps are defined as steps taken during expenditure >4 METS. The pedometer enabled the data to be transferred and saved to a personal computer. These walking steps were measured from December 2014 to August 2015 in Klongyong and from August 2013 to January 2014 in Nikhompattana. The participants reported their results to a project leader during a monthly meeting.

Anthropometry and blood pressure measurements

The anthropometric measurement adopted weight and body mass index (BMI) measurements. The weight measurement used body composition monitors with scales (Omron Healthcare Co., Ltd. JAPAN; HBF-359). Maximum and minimum blood pressures were measured using auscultation (mercury sphygmomanometer, Kenzumedico 0601B001, Japan), after the study participants had been sitting for

Table 1: Program contents of the health education in the Kloyong and Nikhompattana groups

Month	Kloyong program	Nikhompattana program
August	Measurement before the health education	Measurement before the health education
September		Aerobic exercises three times a week
October		Aerobic exercises three times a week
November		Lecture on blood pressure and aerobic exercises three times a week
December	Measurement before the health education	Visit of the temple and aerobic exercises three times a week
January	Lecture of the nutrition, stick exercise, brain train	Measurement after completion of the program
February	Lecture of the nutrition, stick exercise, recreation	
March	Lecture of the hypertension, Tai Chi Chuan, recreation	
April	Lecture of the nutrition, stick exercise, brain training	
May	Lecture of the diabitis, stick exercise, aeroma therapy	
Jun	Lecture of the nutrition, aeroma aerobics excercises	
July	Lecture of the hyper cholesterol, stick e brain training	

Kloyong group: Monthly classroom activity plus weekly 90 min strength and weight training, Nikhompattana group: Monthly classroom activity plus aerobic exercises 3 times per week and at-home training every day

15 min in a room with an ambient temperature of 25°C and relative humidity of approximately 50%.

Physical fitness tests

The physical fitness tests administered in this study were approved by the Japanese Ministry of Education, Culture, Sports, Science, and Technology [15]. The physical fitness test (target age: 65–79 years) included six physical assessments: (1) Grip strength for muscle strength; (2) sit-ups for muscle endurance; (3) sit and reach flexibility for muscle flexibility; (4) eyes-open single-leg stance for balance ability; (5) 10-m obstacle walk for walking ability; and (6) a 6-min walk for endurance. The study participants' physical ability was assessed before and after the health program.

Brain function tests

The go/no-go task [16-18] was used to estimate the inhibitory decision process and comprised three experimental stages: (1) Formation; (2) differentiation, and (3) reverse differentiation. First, in the formation stage, participants were instructed to squeeze a rubber ball in response to a red light that was randomly displayed. The formation stage comprised five trials. Second, during the differentiation stage, the participants squeezed a rubber ball in response to a red light, but not a yellow light, when a red or yellow light was randomly displayed. Third, during the reverse differentiation stages, the participants squeezed a rubber ball in response to yellow light, but not a red light, when a red or yellow light was randomly displayed. In each of the differentiation and reverse differentiation stages, the participants completed 20 trials. Red and yellow lights were equally randomly displayed 10 times each. In this article, the term "miss" indicates an incorrect response when the participants did not squeeze a rubber ball when it should have been squeezed.

Conversely, the term "mistake" means an incorrect response when the participants squeezed the rubber ball when it was not supposed to be squeezed. The participants go/no-go task was assessed before and after the health program.

Statistical analysis

The nonpaired t-test was used to compare the results before and after participation for the steps measured by the pedometer. The paired t-test was used to compare the results before and after participation in the health program. A 2×2 (before and after for each group: Klongyong and Nikhompattana) two-way analysis of variance (ANOVA) with repeated measures on the variable was performed to evaluate for significance in the scores of anthropometry, blood pressure, physical fitness, and go/no-go task. Following the significant interaction, a one-way ANOVA was calculated to interpret the before and after results for Klongyong and Nikhompattana. *Post hoc* tests were performed using Tukey–Kramer correction. The level of significance was set at $p<0.05$. Statistical analyses were performed using the SPSS 11.0.1 statistical package (SPSS Inc., Chicago, USA).

RESULTS

Pedometry

Fig. 1 shows the average daily number of walking and exercise steps for each month in Klongyong and Nikhompattana. In Klongyong, the monthly steps were as follows: December; 3973.6±120.2 (mean±standard error) and exercise steps; 1909.5±137.2, January; 3804.3±139.4 and 1856.2±162.2, February; 4162.4±179.0 and 1631.5±164.9, March; 4070.8±149.9 and 1725.0±106.6, April; 3090.7±104.5 and 1218.4±68.3, May; 2744.0±74.9 and 941.9±45.8, June 2795.2±74.7; 869.8±42.7, July; 3314.8±123.3 and 1166.0±70.0, August; 3285.9±195.9 and 1155.7±121.6. The average number of steps decreased from April to August.

For the 9-month health program, the average walking steps were 3741.3±129.1; the average exercise steps were 1386.0±102.2. In Nikhompattana, the monthly steps observed are as follows: August walking steps 4216.2±440.8 and exercise steps 1502.0±568.3; September, 5031.2±366.8 and 1501.0±127.7; October, 4841.5±314.9 and 1452.9±98.7; November, 4670.1±303.2 and 1317.5±86.2; December, 4751.8±374.3 and 1294.3±112.3; and January, 4662.3±396.5 and 1301.3±112.1. The average steps decreased in October and January; however, not many changes were observed in the average exercise steps from 1200 to 1500 steps in all the months.

For the 6-months, the average walking steps were 4695.5±361.1, and the average exercise steps were 1394.8±183.4. In Klongyong, the average number of walking and exercise steps was 3741.3±129.1 and 1386.0±102.2. Overall, in Nikhompattana, the walking steps (Klongyong: 3741.3±129.1 vs. Nikhompattana; 4695.5±361.1, $p<0.001$) and exercise steps (Klongyong; 1386.0±102.2 vs. Nikhompattana; 1394.8±183.4, $p<0.001$) were significantly higher than in Klongyong (Table 2).

Anthropometry and blood pressure measurements

In Klongyong, a comparison of the anthropometry measurement results before and after the program showed that weight was not significantly different after the program. Notably, in Nikhompattana, weight (before: 61.8 kg±1.1; after: 62.3 kg±1.1, $p<0.01$) and BMI (before: 24.9±0.4; after: 25.2 kg±0.4, $p<0.001$) significantly increased after the program. In Klongyong, a comparison of the blood pressure results from before and after the program showed that maximal blood pressure (before: 134.5 mmHg±4.1; and after: 126.0 mmHg±4.1, $p<0.05$) and minimal blood pressure (before: 77.2 mmHg±2.1; and after: 71.2 mmHg±2.3, $p<0.05$) showed significant decreases; however, in Nikhompattana, no significant differences in maximal and minimal blood pressure were observed (Table 3).

Physical fitness tests

In Klongyong, a comparison of the physical fitness test results from before and after the program showed no significant difference in sit-ups and eyes-open single-leg stance. The sit and reach flexibility (before: 49.9 cm±2.5; and after: 41.5±1.4, $p<0.001$) significantly decreased after the program. The hand grip strength (before: 19.9 kg±0.7; and after: 23.3 kg±1.0, $p<0.001$), 10-m obstacle walk (before: 13.0 s±1.2; and after: 9.4 s±0.6, $p<0.05$), and 6-min walk (before: 362.9 m±13.4; and after: 422.6 m±19.7, $p<0.01$) significantly improved after the program (Table 3).

In Nikhompattana, a comparison the physical fitness test results from before and after the program showed no significant difference in the number of sit-ups, 10-m obstacle walk, and 6-min walk. The hand grip strength (before: 26.3 kg±0.8; and after: 27.8 kg±0.7, $p<0.05$) and sit and reach flexibility (before: 34.4 cm±0.9; and after: 38.0 cm±1.3, $p<0.01$) significantly increased after the program. By contrast, eyes-open single-leg stance (before: 45.0 s±4.1; and after: 35.2 s±3.8, $p<0.01$) significantly decreased after the program. The sit and reach flexibility, 10 m-obstacle, and 6-min walk of interaction of the two-way ANOVA are significantly different (sit-and-reach flexibility; $p<0.001$, 10 m-obstacle; $p<0.001$ and 6-min walk; $p<0.004$). Following the significant interaction, a one-way ANOVA was calculated to interpret the before and after results for the Klongyong sit and reach flexibility and showed a significant decrease (Klongyong before vs. Klongyong after; $p<0.05$); however, for the participants in Klongyong, the 10 m-obstacle, and 6-min walk showed significant improvement (Klongyong before vs. Klongyong after; $p<0.01$ and Klongyong before vs. Klongyong after, $p<0.05$) (Table 3).

Brain function tests

In Klongyong, a comparison of the brain function in the go/no-go task from before and after the program showed no significant differences in formation reaction time, differentiation reaction time, reverse differentiation reaction time, and average reaction time. The total number of misses, mistakes, and errors was not significantly different after the program (Table 3).

In Nikhompattana, a comparison of the brain function in the go/no-go task from before and after the program showed no significant differences in formation and average reaction times. Differentiation reaction times (before: 446.9 ms±9.0; and after: 481.7 ms±10.0, $p<0.001$) and reverse differentiation reaction times (before: 427.6 ms±12.1; and after: 446.2 ms±11.2, $p<0.001$) significantly increased after the program. By contrast, the total number of misses (before: 1.2 times±0.2; and after: 0.3 times±0.1, $p<0.001$), mistakes (before: 5.8 times±0.5; and after: 2.6 times±0.3, $p<0.001$), and errors (before: 7.1 times±0.6; and after: 2.9 times±0.3, $p<0.001$) significantly decreased after the program. The reverse differentiation reaction time, total number of misses, mistakes, and errors of interaction of the two-way ANOVA is significantly different

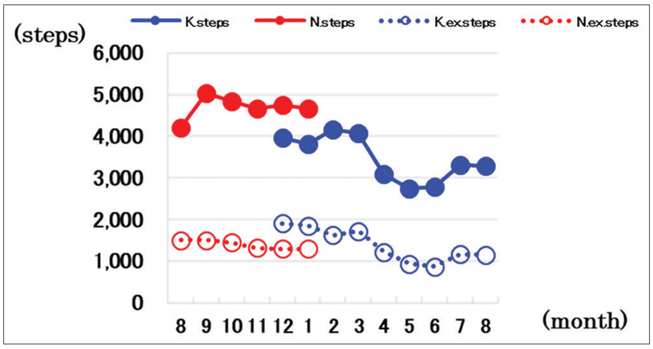

Fig. 1: Daily steps and exercise steps, K: Klongyong, N: Nikhompattana, ex: Exercise steps

Table 2: Comparison of the steps in Kloyong and Nikhompattana

Walking steps	Kloyong	Nikhompattana	p-value
Walking/day (steps)	3471.3±129.1	4965.5±361.1	0.000
Exercise/day (steps)	368.0±102.2	1394.8±183.4	0.006

Table 3: Comparison of pre and post health program in Kloyong and Nikhompattana

Measurement items	K/pre	K/post	p-value	N/pre	N/post	p-value	2 way ANOVA			Tukey-Kramer	
							B • A	K • N	Interaction	K/B • A	N/B • A
Body measurement											
Weight (kg)	55.0±2.3	54.7±2.5	0.482	61.8±1.1	62.3±1.1	0.006	0.743	0.001	0.870		
Body mass index	23.5±1.0	23.4±1.0	0.505	24.9±0.4	25.2±0.4	0.001	0.670	0.025	0.753		
Blood pressure											
Systolic blood pressure	134.5±4.1	126.0±4.1	0.042	134.0±1.7	135.7±1.6	0.271	0.981	0.093	0.082		
Diastolic blood pressure	77.2±2.1	71.2±2.3	0.022	79.2±1.3	79.0±1.0	0.889	0.327	0.010	0.160		
Physical fitness test											
Hand grip strength (kg)	19.9±0.7	23.3±1.0	0.001	26.3±0.8	27.8±0.7	0.002	0.036	0.001	0.372		
Sit up (times)	6.1±1.4	3.1±1.3	0.082	5.1±0.7	5.4±0.9	0.654	0.875	0.651	0.260		
Sit and reach flexibility (cm)	49.9±2.5	41.5±1.4	0.007	34.4±0.9	38.0±1.3	0.004	0.357	0.001	0.001	0.05	NS
Eyes open single leg stance (s)	13.9±2.6	20.4±5.6	0.167	45.0±4.1	35.2±3.8	0.002	0.168	0.001	0.167		
10 m obstacle walk (s)	13.0±1.2	9.4±0.6	0.030	8.5±0.2	8.4±0.2	0.079	0.054	0.001	0.001	0.01	NS
6 min walk (m)	362.9±13.4	442.6±19.7	0.002	514.3±9.6	508.3±8.7	0.778	0.336	0.001	0.004	0.05	NS
Brain function test (go/no‑go task)											
Response											
Formation (ms)	585.9±56.3	745.5±56.3	0.178	356.4±13.5	380.0±14.4	0.119	0.111	0.001	0.092		
Differentiation (ms)	564.0±89.9	515.7±72.9	0.681	446.9±9.0	481.7±10.0	0.001	0.709	0.039	0.260		
Revers differentiation (ms)	566.0±71.3	493.3±40.8	0.391	427.6±12.1	446.2±11.2	0.001	0.495	0.011	0.030	NS	NS
Average (ms)	556.4±48.4	584.9±65.7	0.717	425.1±8.3	446.2±9.6	0.060	0.366	0.001	0.866		
Times											
Total number of misses (times)	0.0±0.0	0.0±0.0	-	1.2±0.2	0.3±0.1	0.001	0.001	0.001	0.016	NS	0.01
Total number of mistakes (times)	5.1±1.1	4.6±1.0	0.707	5.8±0.5	2.6±0.3	0.001	0.001	0.387	0.045	NS	0.01
Total number of errors (times)	5.1±1.1	4.6±1.0	0.707	7.1±0.6	2.9±0.3	0.001	0.001	0.859	0.002	NS	0.01

K: Kloyong, N: Nikhompattana, B: Before, A: After, NS: Not significant

(reverse differentiation; p<0.03, misses; p<0.016, mistakes; p<0.045, and errors; p<0.002). Following the significant interaction, a one-way ANOVA was calculated to interpret the before and after results for the reverse differentiation reaction time and showed no significant difference; however, in Nikhompattana, the total number of misses, mistakes, and errors significantly decreased (Nikhompattana before vs. Nikhompattana after; p<0.016, Nikhompattana before vs. Nikhompattana after; p<0.045, and Nikhompattana before vs. Nikhompattana after; p<0.002) (Table 3).

DISCUSSION

Pedometry

Walking helps prevent diseases and contributes to health improvement [19,20]. In Klongyong, walking and exercise steps were approximately 3471.3 and 1386.0, respectively, and this result was lower than in Nikhompattana, where the walking and exercise steps were approximately 4695.5 and 1394.8, respectively. An investigation in 2011 by the Japanese Ministry of Health, Labor, and Welfare showed that the average number of steps was 7841 for men and 6883 for women aged 20–64 years, and aims for 9000 steps for men and 8500 steps for women by 2020 [21].

Anthropometry and blood pressure measurements

In Nikhompattana, a comparison of the anthropometry results from before and after the program showed that weight significantly increased after the program. In Klongyong, weight increased after the program. In addition, in Nikhompattana, maximal and minimal blood pressures from before and after the program showed no significant differences. By contrast, in Klongyong, maximal and minimal blood pressures showed significant decreases. Regarding the health education provided in Japan, participants' weight, BMI, and blood pressure tended to decrease [12,13]. The significant increase in weight and BMI of the participants' in Nikhompattana maybe because of the shorter duration of the health education enforcement period.

Physical fitness tests

In Klongyong, a comparison of the physical fitness test results from before and after the program showed significant improvements in the hand grip strength, 10 m obstacle walk, and 6-min walk; however, sit and reach flexibility significantly decreased after the program. In Nikhompattana, the hand grip strength and sit and reach flexibility significantly improved after the program; however, eyes-open single-leg stance significantly decreased after the program. The difference in the results may be the effects of the age difference; that is, the Klongyong participants are approximately 10 years older than those in Nikhompattana.

In Klonyong, the physical fitness test results showed that sit-and-reach flexibility significantly decreased. In Nikhompattana, eyes-open single-leg stance significantly decreased after the program. Increased exercise momentum leads improved physical fitness test results [22].

For Klongyong and Nikhompattana, it is desirable to exercise with the goal of walking 7000 steps [11-14]. The 10 m-obstacle walk and 6-min walk of the interaction of the two-way ANOVA suggest that the participants in Klongyong showed significant improvement. It is possible that the significantly increased rate of improvement in Klongyong is because its initial values were higher than in Nikhompattana.

Brain function tests

Go/no-go tasks are frequently used to investigate response inhibition, an essential executive function implemented by the prefrontal cortex, and these tasks recruit a variety of cognitive components in addition to response inhibition [16-18,23,24]. In Nikhompattana, the total number of misses, mistakes, and errors significantly improved after the program. Go/no-go task studies in the literature have suggested that a health program could improve brain function, including working memory [24-26]; in those studies, participants performed regular exercises in the first stage, where go/no-go task reaction times increased and number of error responses decreased significantly. In the second stage, go/no-go task reaction times decreased significantly, and the number of error responses decreased significantly [11-14].

The results from Klongyong suggest that, in the first stage, the go/no-go task reaction time increased and number of error responses decreased. Notably, the results from Nikompattana suggest that, in the first stage, the go/no-go task reaction time increased and number of error responses significantly improved. In other words, the total number of misses, mistakes, and errors of the interaction of the two-way ANOVA suggests that the Nikhompattana showed significant improvement. These results may be due to the greater amount of exercise performed by the Nikhompattana participants. The number of daily mean steps was 1200 more than in Klongyong. It has been suggested that a walk and a walk with dual-task improve brain function [25,26]. The quantity of the exercise might induce the improvement of the brain function [27]. Notably, the initial values were higher in Klonyong than in Nikhompattana. This result may be the reason for the significantly increased rate of improvement in Klongyon.

The limitations of this study

The Japanese Ministry of Education, Culture, Sports, Science, and Technology recommends that Japanese individuals, from elementary school students to elderly people, should measure their physical fitness. Therefore, they are used to taking physical fitness tests. However, elderly people in Thailand have never experienced doing so and, therefore, may not easily understand how to do so. This factor may be one of the causes of Thailand's lower values in the test results. In the future, it is necessary to increase the number of subjects, to implement health education in more areas, and to find the improvement points of the health education system.

CONCLUSIONS

We implemented a 12-month health program in Klongyong and a 6-month health program in Nikhompattana. This health promotion program used the international organization for standardization assessed findings from pedometry, anthropometry, blood pressure, physical fitness, and brain function. In Klongyong, walking and exercise steps were approximately 3471.3 and 1386.0, respectively, which was less than in Nikhompattana, where the walking and exercise steps were approximately 4695.5 and 1394.8, respectively.

In Klongyong, a comparison of the physical fitness test results from before and after the program showed significant improvements in the hand grip strength, 10 m obstacle walk, and 6-min walk; however, sit and reach flexibility significantly decreased after the program. In Nikhompattana, hand grip strength and sit and reach flexibility significantly improved after the program; however, eyes-open single-leg stance significantly decreased after the program. The 10m-obstacle walk and 6-min walk of the interaction of the two-way ANOVA suggest that the Klongyong showed significant improvement, compared with Nikhompattana; however, the significantly increased rate of improvement is because the initial values of Klongyong were higher than those of Nikhompattana. The total number of misses, mistakes, and errors of the interaction of the two-way ANOVA suggests that the Nikhompattana showed significant improvement, compared with Klongyong. These results may be due to the greater amount of exercise performed by the Nikhompattana participants. The number of the daily mean steps was 1200 more than in Klongyong. This result suggested that a walk and a walk with dual-task improve brain function [23,24]. The quantity of the exercise might induce the improvement in brain function [25]. Notably, the initial values of the participants in Klongyong were higher than in Nikhompattana; thus, this phenomenon may have led to the significantly increased rate of improvement in Klongyong.

AUTHOR'S CONTRIBUTIONS

SJ, KT, NP, SK, PU, SS, TW, and NT planned the experiment and collected the data. MO, HT, HK, RU, and KA conducted data analysis. SJ, KT, and HT formulated the composition of the article. All authors read and approved the final manuscript.

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CONFLICTS OF INTREST

There are no conflicts interest.

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