Original Article

Combining Lifestyle Intervention and Competitions in LINE Groups to Promote Weight Loss and Improve Physical Fitness: A Group-Based Program for Thai People

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Background: As obesity increases the risk of chronic diseases. Many countries have developed group-based programs for weight loss and a meta-analysis of diet and physical activity weight loss interventions which have shown that they are effective in promoting weight loss.

Objective: To study the effects of intensive lifestyle intervention combined with competition groups on body mass index.

Materials and Methods: The 120 officers at the Airports of Thailand Public Company Limited (AOT) joined this program for 3 months in the year 2017. The authors allocated the samples into small divisions to enable competitions in LINE groups. During the 3-month program, we provided education, assigned activities, and reported step counts. The parameters studied were body weight, BMI, waist circumference, % Fat, % visceral fat and % muscle. Physical fitness was assessed by recording hand-grip power, number of sit-ups completed in 1 minute, and flexibility before and after the 3-month program.

Results: Seventy-three samples completed the program. Significant reductions were achieved in body weight (75.6 kg to 71.7 kg), BMI (27.3 to 26.0 kg/m^2), waist circumference (90.3 to 83.5 cm) % fat (31.1 to 29.6%), and % visceral fat (11.0 to 9.4%), and a significant increase in the % muscle (27.1 to 27.6%) was also found. Physical fitness improved, including hand-grip power, number of sit-ups completed in 1 minute, and flexibility. There were no significant differences between these changes in male and female groups except that % fat and % muscle improved significantly more in the male group.

Conclusion: A combination of lifestyle intervention and competitions in LINE groups achieved weight loss and enhanced physical fitness.

Keywords: Weight loss, Physical fitness, Line group, Competition, Lifestyle intervention, Group-based program

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Obesity is a risk factor of many chronic diseases including diabetes mellitus, hypertension, dyslipidemia, cardiovascular disease[1,2], bone and joint disease[3,4], fatty liver[5] and various types of cancer (esophageal cancer, stomach cancer, hepatobiliary cancer, pancreatic cancer, breast cancer, endometrial cancer, thyroid cancer and leukemia)[6]. Obesity is associated with insulin resistance, has an impact on disability-adjusted life-years (DALYs) loss and adversely affects quality of life[7-10]. In 2008, managing obesity accounted for 0.7 to 2.8% of health care expenditure in Thailand[11] and this disease now places a considerable financial burden, estimated in 2014 to be about $404 million or 12 billion baht annually[12], on Thai society. In western countries, the cost of obesity management is 0.09 to 0.61% of gross domestic product (GDP)[13].

The prevalence of obesity in Thai people aged more than 15 years, as measured in a Thai national health survey, has increased rapidly. In Thailand, the mean BMI in males increased from 21.6 kg/m^2 in 1992 to 23.3 kg/m^2 in 2009 while the mean female BMI rose from 22.8 kg/m^2 in 1992 to 24.4 kg/m^2 in 2009[14].

One of the potential benefits of a 5% weight loss is prevention of diabetes mellitus (as reported in DPP[15] and LOOK AHEAD studies[16]), and the effect of lifestyle intervention on the prevention of diabetes mellitus is well known. The present study revealed that lifestyle intervention combined with competitions in LINE groups can encourage the target populations to achieve weight loss and improve their physical fitness.

Many countries have developed group-based programs for weight loss, and a meta-analysis of diet and

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physical activity weight loss interventions has shown that they are effective in promoting weight loss in the short term[17,18]. Nowadays, innovations such as LINE groups have made it easy to contact members in order to provide them with health education and motivation. Meanwhile, game competitions are popular with the younger generation, especially in Thailand, where LINE is the 3rd most-commonly used application after FACEBOOK and YOUTUBE; therefore, we decided to conduct a group-based program for weight loss using competitions in LINE groups. The use of LINE groups and competitive games are new methods of attempting to achieve weight loss, so we conducted this study to examine their effectiveness.

The joint committee of the network of Raipoong Thailand ("Flat Belly for Thai people"), under the supervision of the Royal College of Thai Physicians of Internal Medicine, the Diabetes Association of Thailand and the Thai Health Promotion Foundation, developed this project called "increase steps, reduce belly size, and eliminate diseases" (MOU number 59-00-0812, project code 59-00983) to encourage more physical activity, and game competitions were used to increase steps and daily physical exercise in accordance with the project's title.

Objective

Primary objectives

To study the effects of intensive lifestyle intervention combined with competition groups on body mass index.

Secondary objectives

To study the effects of intensive lifestyle intervention combined with competition groups on: (1) body weight and waist circumference; (2) body fat, visceral fat and percentage of muscle; and (3) physical fitness in the form of hand-grip strength, number of sit-ups performed per minute, and flexibility. The last objective was to compare the differences between changes in male and female participants in the parameters of the present study.

Materials and Methods

This was a retrospective study which aimed to collect data from the network of Raipoong Thailand ("Flat Belly for Thai people") about staff at the Airports of Thailand Public Company Limited (AOT) who joined this program in the year 2017 for 3 months (13th June to 8th September 2017). The study protocol was reviewed and approved by The Ethics committee of Rajavithi Hospital (No. 094/2018).

Sample size population

We used a sample size formula for comparisons of means in the same group (two dependent means), and the sample size formula used in this study was:

$$n = \frac{(Z_{\alpha/2} + Z_{\beta})^2 \times (\sigma^2)}{(\Delta)^2}$$

n = sample size

$Z_{\alpha/2} = 1.96$ ($\alpha = 0.05$)

$Z_{\beta} = 0.842$ (power = 80%)

σ^2, SD^2 = variation of population

Δ = mean before-mean after intervention

Using the study of Sadiya A[17] as a reference, we found mean BMI before and after intervention were 40.4±7.4and 38.4±7.4 respectively; therefore, the difference was 2 and the population variation was 7.4. The result of our sample size calculation was 108 cases.

Inclusion criteria

The complete staff of officers at the Airports of Thailand Public Company Limited (AOT) joined this program for 3 months (13th June to 8th September 2017).

Exclusion criteria

AOT officers who did not complete the three-month program were excluded from the study.

The 120 members who participated in this program were divided into 24 groups (5 participants per group), and the project began on 13th June 2017. We provided information via workshops and Line groups about step counting and other ways to increase physical activity.

Intervention program

The framework of this project is shown in Figure 1. The committee of the network of Raipoong Thailand ("Flat Belly for Thai people") applied this framework in a real-life scenario at the Airports of Thailand Public Company Limited (AOT). Starting with a short workshop to record basic physical data and test physical performance, we divided the subjects into groups, and then held question-and-answer sessions with mentors (dieticians and sports scientists) to provide information, respond to queries about empowerment, suggest healthy eating tips, and point out the benefits of increased physical activity via workshop and Line groups every day until the end of the project. Each subject received a pedometer for step-counting, and activities were assigned daily to the participants, who recorded the number of steps they made every day. We gave a reward (an active idol coin) to participants who walked an average of more than 12,500 steps per day, and the winners were announced on our website's hall of fame. We recorded the data until completion of the 3-month program and compared the participants' progress in terms of physical health and fitness.

The methods used to empower subjects to increase their number of steps and embrace healthy lifestyles were as follows: 1) Details of the numbers of steps taken were sent to our website at 2,000 each day, and we updated the data to reveal the cumulative number of individual and team steps via our website and smartphone applications. 2) Tasks were assigned aimed at increasing physical activity; these included cardio, resistance, and flexibility exercises such as exercising for 3 minutes or walking to a Bangkok Mass Transit System (BTS). 3) Healthy eating was encouraged. Participants received written information about GDA

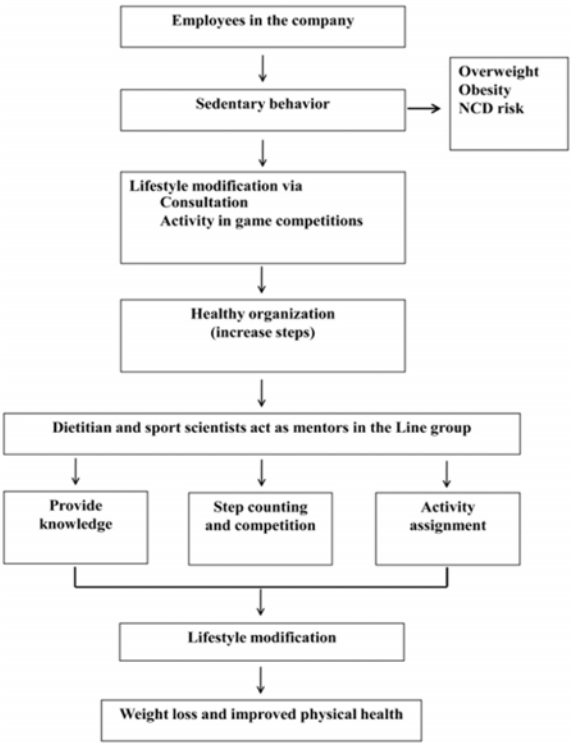

Figure. 1 The framework of "More steps organization".

(guideline daily amount), the calorific values of different foods and drinks, and details about the various types of fat. The participants were encouraged to take photographs of the food and drink they consumed and post them on websites via their smart phones, refrain from eating fried food, increase intake of vegetables, and avoid sugary drinks. The schedule of education, activity and empowerment is shown in Table 1.

The authors assessed physical fitness in terms of: (1) hand-grip strength (using grip strength dynamometer T.K.K 5001 GRIP-A; (2) number of sit-ups completed in 1 minute; (3) flexibility measured by the sit and reach test (GRAND SPORT 383040).

Statistical analysis

The IBM SPSS statistics version 22.0 was for calculations. Descriptive data were reported in terms of number, mean, SD, maximum and minimum. Means were compared using paired t-test for those in the same group, and student t-test for those in different groups. A *p*-value of 0.05 was considered significant.

Results

The 120 members who joined this program were divided into 24 groups (5 participants in each group); however, 47 participants dropped out of the project, and only 73 (in 22 groups) completed the 3-month program.

In the present study, improvements in BMI, BW, WC, % Fat, % visceral fat, and % of muscle were found to be statistically significant (p = 0.001) after the 3-month intervention, as shown in Table 2. The number of participants who achieved weight of loss more than 5% was 27 persons (37.0%) and 9 people (12.3%) reduced their weight by more than 10%. Maximum weight loss by a male was 20.6 kg, and 14.1 kg by a female.

After this program of lifestyle intervention with competition groups, physical fitness improved significantly in all parameters (hand-grip strength, number of sit-ups performed in 1 minute, and flexibility), as shown in Table 3.

There were no differences between baseline characteristics of the male and female groups in terms of age, number of steps per day, number of sit-ups completed in 1 minute or flexibility; however, baseline hand-grip strength, body weight, waist circumference, BMI, % visceral fat, % muscle were all higher in the male group than in the female one, and only baseline % fat was higher in the female group. After the 3-month intervention, improvements were found in both groups in the following parameters: body weight; waist circumference; BMI; % visceral fat; % muscle; hand-grip strength; number of sit-ups completed in 1 minute; and flexibility. There were no between-group differences in % change of the following parameters: body weight; waist circumference; BMI; % visceral fat; hand-grip strength; number of sit-ups performed in 1 minute; or flexibility. Percentage change of fat and muscle, however, was significantly better in the male group than in the female one. The data are shown in Table 4.

The average number steps in this program was 17,579 steps per person per day. Fifty-six participants walked an average of more than 12,500 steps per day and received active idol coins. The average number of steps of a Thai person is 4,764 steps per day[19]. The total number of steps in this program was 117,107,083 steps, which is equivalent to 81,974 kilometers, and the total calories burnt was 5,855,354 kcal.

Discussion

The results of the present study show the effectiveness of a combination of lifestyle intervention and competitions in LINE groups in achieving weight loss and improved physical fitness. This group-based program with Thai people was equally effective in both males and females of working age, and most weight-loss parameters and overall physical fitness in both genders improved after intervention.

The authors compared the results of other studies with our own. One systematic review revealed benefits of group-based programs in achieving weight loss, but the results varied with intervention design in terms of feedback, target weight loss, and dietary goals[18], and more success was found in male groups[18]. The present study showed no difference between the weight loss achieved by males and females; however, the male group in our study obtained greater reductions in body fat and increases in muscle.

The results of a study which used smartphone applications for weight loss revealed no advantage of this

Table 1. The schedule of education, activity and empowerment program during 12 weeks

Time	Knowledge	Mission	
1st week			
D1	Composition of the body	Calculate body fat	Calculate BMI
D2	Are you obese?		
D3	Weight loss or fat reduction		
D4	The appropriate body weight	Aim for fat loss	Find the method to
D5	Metabolic syndrome		loss your weight
D6	The effect of obesity		
D7	Motivation		
2nd week			
D1	Activity and exercise	Walk more than 10,000	Find motivation foe
D2	Change your mind	steps at least 3 days	weight reduction
D3	10,000 steps per day (Why?)		
D4	How to lost your weight?		
D5	Use the step		
D6	Know calories		
D7	Motivation		
3rd week			
D1	Energy balance	Take at least one picture	Take at least one picture of
D2	Plate model	of activity per day at	your plate follow plate model
D3	Energy in one day	least 3 days	per day at least 3 days
D4	Read food composition label		
D5	Activity and weight reduction		
D6	How to choose fat		
D7	Motivation		
4th week			Answer the question
D1	FITT technique		About exercise
D2	Why you not decide to lose weight?	About diet	
D3	Exercise 3 patterns		About exercise
D4	High calories drink	About diet	
D5	Preparing for exercise		About exercise
D6	How to eat buffet?	Knowledge about diet	
D7	Motivation		
5th week			
D1	Test your fitness	VDO exercise at least	VDO healthy break at least
D2	Healthy diet	3 days per week	3 days per week
D3	Warm up		
D4	Healthy break		
D5	Cool down		
D6	Fat		
D7	Motivation		
6th week			
D1	Aerobic exercise	Take VDO of exercise	Take picture your eating fruits
D2	Fruit	3 patterns in 1 week	
D3	Resistance exercise		
D4	Diet during watching TV		
D5	Flexibility exercise		
D6	Sell food		
D7	Motivation		
7th week			
D1	Intensity of aerobic exercise (heart rate)	Take VDO of aerobic	No fried food or coconut at
D2	Low fat = Low calorie?	exercise 3 days in 1 week	least 3 pictures in 1 week
D3	Intensity of aerobic exercise (talk test)		
D4	Time for dinner		
D5	Separate time for exercise		
D6	Cheating day		
D7	Motivation		

Table 1. Cont.

Time	Knowledge	Mission	
8th week			
D1	Resistance exercise	VDO training of each	Plate model
D2	Fiber diet	group of muscles	Answer: high fiber diet in fruits
D3	Target of resistance exercise		
D4	Example of plate model		
D5	DOMS		
D6	Causes of unachieved weight loss		
D7	Motivation		
9th week			
D1	Benefit of flexibility exercise	Flexibility exercise	Drink milk at least 3 days
D2	6 tea spoon of sugar	at least 3 days	
D3	Types of flexibility exercise	Simple	
D4	Good fat	Dynamic stretching	
D5	Yoga	Static stretching	
D6	Low salt diet		
D7	Motivation		
10th week			
D1	Circuit training	Circuit training at least	Plate before and after
D2	Smaller plate	3 days	
D3	Circuit training		
D4	Hunger scale		
D5	Circuit training		
D6	Early brush teeth at night time		
D7	Motivation		
11th week			
D1	HIIT	VDO HIIT	Drink water at least 3 days
D2	Drinking more water		
D3	Begin HIIT training		
D4	Avoid spicy food		
D5	Caution of HIIT training		
D6	Don't regret the rest food		
D7	Motivation		
12th week			
D1	Marathon running	Aerobic exercise,	Sugar, salt and fat per day
D2	Use more time to chew	Resistance exercise	How to choose oil?
D3	Safety of marathon running	and flexibility exercise	Summary of weight reduction
D4	Organization the refrigerator	at least in 1 week	
D5	Reduction of marathon running injury		
D6	Targets of lifestyle change		
D7	Motivation		

Table 2. The differences in BMI, BW, WC, % Fat, % visceral fat and % of muscle before and after the program of lifestyle intervention with competition groups for weight loss

Variables	Before (n = 73) Mean ± SD (min-max)	After (n = 73) Mean ± SD (min-max)	*p*-value
Body weight (kg)	75.6±17.4 (45.2 to 136.2)	71.7±16.0 (44.7 to 133.4)	0.001*
Waist circumference (cm)	90.3±13.1 (62.0 to 127.5)	83.5±13.1 (56.0 to 122.0)	0.001*
BMI (kg/m^2)	27.3±4.9 (16.3 to 43.5)	26.0±4.5 (16.1 to 42.6)	0.001*
% FAT	31.1±5.5 (18.5 to 44.6)	29.6±5.9 (18.2 to 43.0)	0.001*
% VFAT	11.0±6.5 (0.5 to 30.0)	9.4±5.7 (0.5 to 30.0)	0.001*
% Muscle	27.1±3.5 (20.1 to 34.6)	27.6±3.8 (21.0 to 35.9)	0.001*

Values are represented as mean ± SD (min-max)
* = Significant at $p<0.05$

Table 3. The differences in physical fitness (hand-grip strength, number of sit-ups performed in 1 minute, and flexibility before and after the program of lifestyle intervention with competition groups for weight loss

Variables	Before Mean ± SD (min-max)	After Mean ± SD (min-max)	*p*-value
Hand-grip strength (kg)	66.10±20.5 (36.0 to 131.5)	68.7±20.3 (42.0 to 121.0)	0.002*
Number of sit-ups in 1 minute	44.10±8.9 (25.0 to 66.0)	59.9±11.3 (35.0 to 89.0)	0.001*
Flexibility (cm)	1.41±10.2 (-28.0 to 18.0)	10.3±9.8 (-30.0 to 30.0)	0.001*

Values are represented as mean ± SD (min-max)
* = Significant at $p<0.05$

Table 4. The baseline characteristics and parameters before and after the intervention in the male and female groups

Variables	Male (n = 31) Mean ± SD (min-max)	Female (n = 42) Mean ± SD (min-max)	*p*-value
Age	36.6±9.0 (23 to 58)	37.9±8.7 (24 to 58)	0.525
Number of steps per day	18,279±12,916.7 (2,189 to 56,850)	16,478±8,305.4 (6,150 to 50,855)	0.471
Body weight (kg)			
Before	89.0±14.1 (70.9 to 136.2)	65.7±12.3 (45.2 to 94.0)	0.001*
After	83.4±13.4 (65.0 to 133.0)	63.1±11.6 (44.7 to 92.0)	0.001*
% change of BW	-6.0±6.4 (-20.0 to (-1.0)	-3.7±3.9 (-20.0 to 3.0)	0.063
Waist circumference (cm)			
Before	99.2±9.5	83.8±11.5	0.001*
After	91.5±11.1	77.5±11.8	0.001*
% change of WC	-7.6±7.8 (-20.0 to 10.0)	-7.4±6.7 (-22.0 to 10.0)	0.904
BMI (kg/m^2)			
Before	30.1±4.0 (23.7 to 43.5)	25.3±4.6 (16.3 to 35.0)	0.001*
After	28.2±3.8 (21.2 to 42.6)	24.3±4.3 (16.1 to 33.8)	0.001*
% change of BMI	-6.0± 6.4 (-20.0 to 1.0)	-3.7±3.9 (-20.0 to 3.0)	0.063
% FAT			
Before	28.4±4.0 (19.2 to 39.0)	33.2±5.7 (18.5 to 44.6)	0.001*
After	25.8±4.5 (18.2 to 37.8)	32.4±5.3 (19.0 to 43.0)	0.001*
% change of FAT	-8.9±9.4	-2.3±4.0	0.001*
% Visceral FAT			
Before	15.9±5.3 (7.5 to 30.0)	7.4±4.7 (0.5 to 20.0)	0.001*
After	13.6±4.8 (5.0 to 30.0)	6.3±4.0 (0.5 to 19.0)	0.001*
% change of visceral FAT	-13.7±16.0 (-33.0 to 8.0)	-12.42±13.5 (-14.0 to 6.0)	0.699
% Muscle			
Before	30.2±1.9 (25.9 to 34.6)	24.7±2.4 (20.1 to 30.4)	0.001*
After	31.2±2.1 (26.9 to 35.9)	24.9±2.2 (21.0 to 30.0)	0.001*
% change of muscle	3.3±3.7 (-4.0 to 13.0)	0.9±3.3 (-11.0 to 8.0)	0.005*
Hand-grip strength (kg)			
Before	83.7±18.0 (43.5 to 131.5)	53.1±9.5 (36.0 to 78.0)	0.001*
After	86.7±17.2 (49.0 to 121.0)	55.4±8.8 (42.0 to 83.0)	0.001*
% change	4.6±11.7 (-15.0 to 28.0)	5.2±9.3 (-12.0 to 24.0)	0.8
Sit-ups in 1 minute			
Before	46.3±9.4 (26.0 to 66.0)	42.4±8.2 (25.0 to 65.0)	0.64
After	62.5±11.6 (40.0 to 80.0)	58.0±10.8 (35.0 to 89.0)	0.71
% change	39.1±32.7 (-18.0 to 100.0)	39.4±29.7 (-18.0 to 108)	0.055
Flexibility (cm)			
Before	-0.8±12.0 (-28.0 to 17.0)	3.0±8.5 (-22.0 to 18.0)	0.116
After	9.6±12.2 (-30.0 to 30.0)	10.8±7.7 (-7.0 to 27.0)	0.611
% change	1.3±2.2 (-400.0 to 700.0)	1.8±3.0 (-320 to 1,100)	0.465

Values are represented as mean ± SD (min-max)
* = Significant at $p<0.05$

method over traditional ones[20]. Commercial mobile apps for weight loss/management lack important evidence-based features, and the validity of their claims regarding their effectiveness and safety are questionable[21], so the efficacy of these applications should be tested using randomized controlled trials[22]. The study of Diet Bet, a Web-based program that used social gaming and financial incentives to promote weight loss, produced excellent 4-week weight loss results[23]. In the present study, the author did not give financial incentives; we merely awarded active idol coins and listed participants' names in our website's hall of fame, and this may show that financial rewards may not be necessary incentives.

The strength of the present study was that it compared groups before and after treatment in LINE groups involving provision of knowledge and motivation. The authors recorded changes in body parameters and physical fitness and compared the differences in results attained by male and female participants.

One limitation of this study was there was no control group for comparison; however, achieving significant weight loss without intervention is no easy feat, and the intervention showed that ensuring health literacy and employing competitive games in Line groups are effective means of procuring weight loss and enhancing physical fitness. A second limitation was that 47 of the 120 subjects (39.2%) dropped out before completing the program, which suggests that this intervention may not be appropriate for all subjects and age groups; however, it should be pointed out that about two-thirds of the subjects had successful outcomes. The third limitation of this research was that it was a short-term study for 3 only months, and we have no data to enable us to establish whether or not this intervention would be effective in the long term and improve cardiovascular health in the future.

The authors suggest that this program can be applied in real life scenarios to achieve weight loss and improve physical fitness, and we plan to conduct this program again with other companies such as the Bank of Thailand, or other age groups, including children in schools and the elderly in many communities. The major question about this program is whether or not it can be sustainable in the long term, and the authors are therefore going to follow-up with long-term studies of at least 1 to 2 years.

Conclusion

The effects of a combination of lifestyle intervention with competitions in LINE groups achieved weight loss and enhanced physical fitness. There were no differences between the results of the male and female groups, but the males attained better body composition than the females in terms of reduced fat and increased muscle.

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What is already known on this topic?

A combination of lifestyle intervention achieved weight loss and enhanced physical fitness.

What this study adds?

A combination of lifestyle intervention and competitions in LINE groups achieved weight loss and enhanced physical fitness in group base program and we may applied to Thai group base program. The benefit to body composition is better in male than female. The reward for competition may not be money or high cost value.

Potential conflicts of interest

This work received independent research funding from the Thai Health Promotion Foundation and was conducted by the network of Raipoong Thailand (promotion of "flat bellies" for Thai people).

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