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New Approach for Obesity Treatment Incorporating Individual Self-Management Education

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Abstract

Background: Obesity is a global issue, and its prevalence is a major public health concern. To help resolve this obesity epidemic, we propose an education program for positive behavior change. This program incorporates diet and exercise behaviors at the individual level.

Objective: To demonstrate the effects of a new approach for treating obesity by improving individual self-management through investigating, i) behavior modification in the treatment of obesity, ii) the change of obesity states and physical performance capacity, and iii) the risk factors to be diagnosed with metabolic syndrome.

Design: Twenty-four men during the 2011 and thirty-three men during the 2012 intervention contributed to the current study. Over 12 weeks, a total of 57 subjects participated in individual self-management education program.

Results: For a short-term program, in both the years 2011 and 2012 subjects showed a decrease in daily energy intake (-30.1% and -27.7%) accompanied by an increase in daily energy expenditure (+5.7% and +5.9%), suggesting an ability of individuals to keep obesity under control through behavior therapy. Subjects also showed a marked change in obesity states and physical capacity such as decreased body weight (-12.1% and -13.6%), and higher VO_2max (+22.0% and +21.4%). Further, our comprehensive protocol led to a improvement in components for metabolic syndrome; reduction in waist circumference (-10.4% and -11.7%), blood pressure (systolic: -12.9% and -9.8%; diastolic: -14.6% and -9.6%), fasting plasma glucose (-8.6%, -7.6%), and triglyceride (-60.6% and -46.7%) along with an increase in the levels of HDL-C (+16.5% and +10.5%) was seen.

Conclusion: Under our protocol, subjects achieved optimal results for treating obesity during two consecutive years. We recognize that these results are due to an acquired ability like broader perspective and greater acumen about individual obesity management. Therefore, the methods and delivery of our new public approach are useful to the general public.

Keywords: Obesity; Self-management ability; Dietary and exercise intervention; Public health; New obesity approach

Introduction

Prevalence of obesity (body mass index; BMI, over 25 kg/m^2 defined) in Japan [1] is over 30% in adult men between the age of 20-60 years. Over the past 15 years, this rate has risen by approximately 20% [2]. Figure 1 shows such a trend in comparison with that of the United States (BMI over 30 kg/m^2 defined) [3]. Such an increase in obesity, especially in middle-aged men, elevates the risk of mortality and morbidity, which is a major public health concern in Japan [4]. Clinically, it has been well established that obesity is an underlying factor for several chronic diseases including Cardiovascular Disease (CVD), hypertension, cancer, stroke, and type 2 diabetes [5]. Moreover, obesity and its comorbid conditions are associated with negative health consequences, including low physical capacity and psychological distress, as well as other impacts such as social stigma and high socioeconomic cost [6-9]. Hence, obesity should be recognized as a serious disease, and actively prevented and treated [10,11].

Obesity is the result of various deteriorated physiological systems that lead to an imbalance between energy intake and expenditure [12]. Hence, any factor that increases energy intake or decreases energy expenditure by even a small amount will trigger obesity in the long term. Hereditary effects cannot be ignored in individual predisposition to obesity [13]. However, prevalence of obesity at present indicates that environmental factors must underlie the obesity epidemic. Thus, obesity management ultimately associates with eating less and being more physically active. Though this action sounds easy, such a simplistic approach is extremely hard to follow and control. In particular, maintaining the decreased weight-loss goal is much more difficult; there is almost always a regain in weight of about 40% within the first year following treatment and the rest within three years [14]. In addition, it is necessary to cautiously apply a weight-loss program, because repeated trial and failure add further adverse effects such as physical and psychological damage. Hence, it is necessary to re-consider the fundamental reasons and to concentrate on seeking new options for efficient obesity management, especially at the societal level. We hypothesize that the reason is due to an absence of individual self-management ability-related diet and exercise behaviors.

Although an increasing number of clinical researchers have been aggressively working to find optimal ways of preventing and treating obesity, including dieting, exercising, behavioral treatments, pharmacotherapy, and surgery [15-18], recent evidence suggests that

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although sometimes effective, the benefits of these approaches are uncertain and controversial. Treatment is not effective for the most seriously obese, and the majority of these people struggle in vain to lose weight, tending to blame themselves for relapses [19]. One reason for these problems may be that general anti-obesity approaches mostly rely on prescribed methods for isolated factors rather than a more holistic approach [9,17]. The highly prescriptive regimes on which these approaches depend are difficult for obese individuals to integrate into their existing lifestyle. Also, to resolve such problems in effectively implementing this type of program, one-on-one assistance from obesity-related specialists (e.g., doctors, dietitians, counselors, physical trainers, psychologists, and behaviorists) can make such approaches costly and time consuming, rendering them potentially unsustainable at the societal level [20]. Thus, such approaches are expected to be neither effective nor permanent without individual awakening. In recent years we have seen the availability of numerous therapies and approaches for obesity management. But, it is often difficult and confusing for an obese individual to choose the appropriate strategy or exclude an inappropriate strategy [20]. We do not at all wish to imply that the numerous recommended treatment guidelines for obese individuals [17,21-23] are of no help, but rather would like to state that sometimes the contents are too difficult or too rigid to be selected by the individual. Hence, it is our belief that obese individuals might need a professional to counsel, advise, and explain basic knowledge regarding obesity until they acquire the ability to self-manage; i.e., capable of choosing an appropriate program for their own particular health condition, to manage their plan, and to overcome associated barriers.

Based on these considerations, in this study we strived to advance a previously established support program, consisting of dietary restriction and exercise, to a new conative program that includes goal setting, lifestyle skills teaching, and health checking. The program is meant to recognize various individual states, and at the same time help participants formulate their own regime out of their own volition. The purpose of this study, therefore, was to demonstrate the impact of our new obesity treatment incorporating individual self-management education. We did this by i) estimating behavior modification in the treatment of obesity, ii) evaluating the change of obesity states and physical capacity, and iii) investigating the reduction in risk factors related to metabolic syndrome. In all, we present a new public health approach for obesity.

Materials and Methods

Clinical study design

Figure 2 presents a simple workflow of enrollment to the program and contents of the class. The study was performed from June through October, 2011 and 2012 at the University of Tsukuba, Japan. Obese adult men (BMI between 25 and 35 kg/m^2), were recruited from Ibaraki prefecture (Kanto region of Japan). A total of 67 men (years 2011:28 men, and 2012: 39 men) were recruited through advertisements in a local newspaper, fliers, and a public broadcast on local cable TV. For 12 weeks, the 67 participants received a dietary and exercise education program including goal setting, lifestyle skills teaching, and health checks, aimed at improving individual self-management ability. For substantial analysis, we excluded 10 men (years 2011: 4 men and 2012: 6 men) because of drop out, low attendance (<30%) and deficit of data during the intervention. Consequently, of the initial 67 participants, data from 57 subjects from the two years (2011 and 2012) of study were analyzed and are presented in the current study. The study was approved by the Institutional Review Board at the University of Tsukuba, and all study participants agreed to the study with written informed consent.

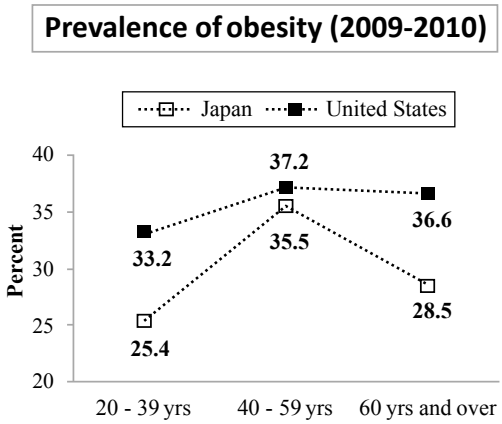

Figure 1: Comparison of the prevalence of obesity in the over 20 age group in Japan and United States between 2009 and 2010. The Body Mass Index (BMI) was over 25 kg/m^2 and 30 kg/m^2 in Japan and United States, respectively. The data represent percentage of obese people in each age group (20-39 years, 40-59 years, and 60 years and older).

Key program features

Dietary education program: Subjects were provided with a dietary education program through 12 weekly lectures. The program consisted of dietary lectures and small interactive group sessions on individual self-management. During the 12 lectures, subjects mainly learned methods for calculating dietary calories by weighing food, were given information about a nutritionally balanced diet, and planned a dietary program on their own. Our job was to help them adjust to the program through continuous and repetitive training. For self-monitoring, participants kept food diaries including several daily reports, e.g. personal goal setting, body weight change, and physical and mental conditions. Skilled dieticians offered comments on subjects' food diaries and provided one-on-one dietary behavioral counseling after each lecture. Though we did not strictly demand subjects to follow said guidelines, we recommended guidelines for proper consumption and energy balance. Small interactive group sessions were added to encourage all participants to modify their own dietary behaviour. Subjects were encouraged to share their experiences and ideas for obesity treatment.

Exercise education program: In an exercise education class, carried out under the supervision of skilled professional trainers, subjects did aerobic exercise with the following regimen. i) 15-20 min warm-up session, which included stretching, ii) 40-60 min walking and/or jogging session, and iii) 15-20 min cool-down session that included resistance training using body weight (Figure 2). This class was conducted for 90 min per day three times a week for 12 weeks. By taking part in the above program, subjects learned about exercise, such as the right way of walking or how to prevent injury during exercise and how to increase exercise intensity, time, and frequency according to their physical condition. The trainers also explained basic training methods e.g., stretching, resistance training, and how the training can affect their bodies. Progressively with each session, subjects were given fewer direct instructions as to the intensity and time of the given exercise. Instead, it was emphasized that subjects control, as best as possible, the amount of exercise appropriate for their health condition. Short-range telemetry (Polar RS400, Kempele, Finland) was made available during the exercise program to encourage participants to monitor their cardiovascular exercise intensity.

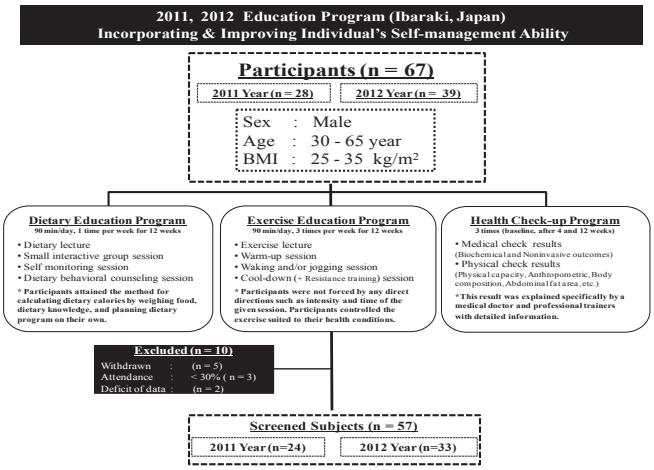

Figure 2: The scheme of educational program for obesity treatment by improving individual's self-management ability. The enrollment program and contents are illustrated.

Additional advice and information

During the study periods, subjects were not firmly restricted to our program, but were allowed to incorporate their previous regimen into our program, and were given detailed advice on how to do so. In addition, at three times-baseline, 4 weeks, and 12 weeks-subjects underwent medical and physical check-ups and received detailed information on their health condition, explained by a medical doctor and professional trainers (Figure 2). With this information, we expected subjects to perform a self-evaluation of their health condition, and based on the evaluation, individuals were expected to control and manage their progress. Moreover, skilled staff members responded to participants' for counseling on issues related to physical problems, psychological distress, and medical and social situations.

Energy intake and expenditure analyses

After receiving detailed instructions and under the supervision of a dietician, subjects completed a 3-day food record for Total Energy Intake (TEI) assessments at baseline and at week 12. A professional dietician used the food-intake records to estimate daily energy intake and macronutrient composition using commercially available software (Excel Eiyo-kun; Kenpakusya, Tokyo, Japan). Total Energy Expenditure (TEE) and steps per day were measured by a single-axis pedometer (Lifecorder; Suzuken Co. Ltd., Nagoya, Japan). The pedometer was firmly attached to the subject's clothing during all activity hours except while bathing and sleeping, beginning two weeks prior to the intervention period, and throughout the entire 12 week program. Detailed descriptions of the accelerometer have been previously published by Kumahara et al. [24].

Anthropometric, MRI, DEXA, and ultrasound analyses

We measured body weight to within 0.1 kg with the participants dressed in a light gown using a digital electronic scale (TBF-551; Tanita, Tokyo, Japan), and standing height to within 0.1 cm with a wall-mounted stadiometer (YG-200; Yagami, Nagoya, Japan). Fat mass and lean body mass were measured by using dual energy x-ray absorptiometry (DEXA; QDR 4500, Hologic Inc., Bedford, MA). The data were used to calculate percentage body fat. Abdominal fat area was determined by magnetic resonance imaging (MRI; Erlangen, Germany, 3.0-Tesla system, Achieva R3.2, Philips, Netherlands) in which the Total Abdominal Fat Area (TAFA), Subcutaneous Abdominal Fat Area (SAFA), and Visceral Abdominal Fat Area (VAFA) were evaluated at the level of the umbilicus. Waist Circumference (WC) was measured to within 0.1 cm using a glass fiber tape at the umbilicus level. Hepatic steatosis was also performed by a clinical gastroenterologist using an ultrasound system (Nemyo MX; Toshiba medical systems, Tokyo, Japan) with a 3.5-5.0 MHz curved array transducer.

Metabolic parameters analyses

Maximal oxygen uptake (VO_2max test) for 57 subjects was performed under the supervision of a medical doctor and a physical trainer using a graded direct cycling ergometer (Monark, model 828E, Stockholm, Sweden) at baseline and at week 12. Following a 2-min warm-up period at 30 watts (W), workload was increased every 1 minute by 15 W intervals until volitional exhaustion. Ventilations and gas exchanges were evaluated using an indirect calorimeter (Oxycon, Mijnhardt, Breda, The Netherlands and Minato Medical Science, Tokyo, Japan), and heart rate (HR) was assessed using an electrocardiograph (Dyna Scope, Fukudadenshi, Tokyo, Japan). Systolic and diastolic blood pressure (SBP and DBP) were measured on the right arm using a mercury sphygmomanometer. Also, to calculate physical fitness age, participants performed tests (side step, one-leg stance with eyes closed, trunk flexion, trunk extension, vertical jump and grip strength) to measure balance, agility, flexibility, muscle strength and endurance. Using these parameters, physical age was calculated as per Lee et al. [25]

Biochemical analysis of blood

Blood samples were collected by inserting a butterfly needle into the median cubital vein following no exercise for 48 hours and a fast status for 12 hours, at baseline and at week 12. The collected blood was separated into serum and plasma from the clot by centrifugation (2000 g for 15 min, 4°C) and stored at -80°C until analyzed. Levels of Triglycerides (TG) and high density lipoprotein-cholesterol (HDL-C) were analyzed enzymatically. Fasting Plasma Glucose (FPG) level was analyzed by the enzymatic colorimetric method.

Surrogate parameters

Surrogate markers were calculated as follows: Physical age was determined according to the equation of Lee et al. [25]. We used the definition for metabolic syndrome proposed by the National Cholesterol Education Program-Adult Treatment Panel III from 2001, which was revised in 2005. It is based on the fulfillment of any three of five risk factors. The criterion for waist circumference in this study (≥ 85 cm) is that used by the Japan Society for the Study of Obesity. The five risk factors are i) waist circumference equal to or greater than 85 cm, ii) triglycerides equal to or greater than 150 mg/dL, iii) HDL-C less than 40 mg/dL, iv) blood pressure equal to or greater than 130/85 mmHg, and v) fasting glucose equal to or greater than 100 mg/dL [26].

Statistical analysis

Statistical analysis was performed by using SPSS Statistics for Windows, version 20.0 (IBM Inc., Armonk, NY, USA). Descriptive parameters show the mean, standard deviation or proportion (%). In case of categorical variables, the chi-square test was used. To compare intra-group changes over time (at the baseline and 12th week), all dependent variables were analyzed using one-way repeated measures ANOVA. The threshold for significance was denoted at $p<0.05$.

Results

Data from a total of 57 subjects, 24 of whom participated during the 2011 intervention and 33 during the 2012 intervention, were analyzed, presented, and discussed in the present study.

Energy intake and expenditure parameters

Table 1 presents the parameters estimating behavior modification. According to the three-day food records, all subjects showed a significant decrease in TEI, fat, and carbohydrate intake per day. However, for the protein intake per day data, a significant ($p<0.05$) decrease from baseline to week 12 was seen in the 2012 subjects, but the decrease was not as significant for subjects in 2011. The TEE and steps per day parameters showed significant increase at week 12.

Obesity states

The parameters evaluating change of obesity states are presented in table 2a. Body weight was significantly decreased at week 12. In addition, 12 weeks of lifestyle improvement promoted by education on exercise and diet resulted in significant reductions in TAFA, VAFA, and SAFA as assessed by MRI, and in percentage body fat as determined by DEXA. Ultrasound analysis also revealed that the number of obese subject with liver steatosis significantly decreased.

Physical performance capacity

Table 2b presents the parameters for physical performance capacity. The data show significant improvement in VO_{2max}, physical age, and resting heart rate suggesting that physical performance capacity increased during the 12 weeks of education.

Risk factors for metabolic syndrome

The risk factors related to metabolic syndrome examined in this study for each subject from baseline to 12 weeks is shown in table 3. After 12 week program, significant reduction in parameters including WC, SBP, DBP, FPG, and TG were seen, while, significant increase in HDL-C was seen. The number of components for metabolic syndrome according to diagnostic criteria in Japan [26] revealed significant decrease under our protocol.

Parameter	Year	Baseline	After 12 weeks	%Difference
TEI (kcal/day)	2011	2275.4 ± 530.8	1590.0 ± 372.4	-30.1*
	2012	2158.5 ± 396.0	1560.0 ± 236.7	-27.7*
	Total	2207.7 ± 456.9	1572.6 ± 298.7	-28.8*
Protein (kcal/day)	2011	75.2 ± 17.2	75.2 ± 17.2	-8.4
	2012	86.8 ± 18.7	78.0 ± 16.8	-10.1*
	Total	81.8 ± 18.9	74.3 ± 16.7	-9.2*
Fat (kcal/day)	2011	62.9 ± 15.3	46.4 ± 14.5	-26.2 *
	2012	58.6 ± 17.0	40.3 ± 10.5	-31.2*
	Total	60.4 ± 16.3	42.8 ± 12.6	-29.1*
Carbohydrate (kcal/day)	2011	302.5 ± 60.1	212.4 ± 52.0	-29.8*
	2012	294.9 ± 69.3	213.6 ± 31.6	-27.6*
	Total	60.4 ± 16.3	42.8 ± 12.6	-29.1*
TEE (kcal/day)	2011	2357.6 ± 252.5	2491.9 ± 274.5	+5.7*
	2012	2393.3 ± 219.0	2533.6 ± 289.8	+5.9*
	Total	2378.3 ± 232.2	2516.0 ± 281.8	+5.8*
Steps (number/day)	2011	7830.0 ± 2917.0	11729.8 ± 3381.1	+49.8*
	2012	7190.6 ± 2389.7	11750.1 ± 4186.8	+63.4*
	Total	7459 ± 2619.0	11741.5 ± 3835.6	+56.1*

Values are presented as the group means ± SD. Significant difference was denoted (*p <0.05). Abbreviations: TEI: Total Energy Intake; TEE: Total Energy Expenditure

Table 1: Total energy intake and expenditure before and after the 12-week program.

Parameter	Year	Baseline	After 12 weeks	%Difference
a) Obesity states				
Weight (Kg)	2011	82.0 ± 11.4	72.1 ± 10.4	-12.1*
	2012	86.0 ± 10.2	74.3 ± 8.7	-13.6*
	Total	84.3 ± 10.9	73.4 ± 9.	-13.6*
TAFA (cm^2)	2011	398.4 ± 103.3	249.2 ± 87.7	-37.4*
	2012	386.4 ± 72.8	229.2 ± 86.4	-40.7*
	Total	391.7 ± 86.3	237.7 ± 86.7	-39.3*
VAFA (cm^2)	2011	164.1 ± 75.2	97.4 ± 55.3	-40.6*
	2012	163.6 ± 44.9	91.5 ± 51.2	-44.0*
	Total	163.8 ± 44.9	94.0 ± 52.6	-42.6*
Percentage body fat	2011	24.3 ± 2.8	19.9 ± 2.9	-18.5*
	2012	26.4 ± 4.0	20.9 ± 5.0	-20.8*
	Total	25.6 ± 3.7	20.5 ± 4.3	-19.9*
Liver steatosis (% people)	2011	98.5	25.0	-73.9*
	2012	97.0	24.2	-74.9*
	Total	96.5	24.6	-74.5*
(b) Physical performance capacity				
VO_2 max (ml/Kg/min)	2011	28.6 ± 5.4	34.9 ± 6.7	+22.0*
	2012	29.0 ± 5.6	35.3 ± 6.8	+21.4*
	Total	28.9 ± 5.5	35.1 ± 6.7	+21.8*
Physical age (years)	2011	55.3 ± 7.8	49.4 ± 9.0	-10.7*
	2012	53.0 ± 10.1	46.2 ± 12.7	-12.8*
	Total	54.0 ± 9.3	47.5 ± 11.4	-11.9*
Resting HR (bpm)	2011	70.0 ± 5.9	63.8 ± 7.2	-8.9*
	2012	69.2 ± 5.6	63.0 ± 8.4	-9.0*
	Total	69.5 ± 5.7	63.3 ± 7.9	-8.9*

Values are presented as the group means ± SD or proportion (%). Significant difference was denoted (*p<0.05). [1]p values are results of the chi-square test. Abbreviations: TAFA: Total Abdominal Fat Area; VAFA: Visceral Abdominal Fat Area; Vo_2max: Maximal Oxygen Uptake; Resting HR: Resting Heart Rate.

Table 2: Changes in obesity state and physical capacity before and after the 12-week program.

Discussion

One of the most urgent tasks for public health in the 21st century is conquering the epidemic of obesity [27]. Despite numerous attempts worldwide to address obesity through prevention and treatment, there is no letup in its rapid global increase. The problem does not seem to go away simply-it is even more difficult to combat, since its causes have become so intertwined in social, environmental, and governmental aspects. Currently, there is no common agreement on the specific causes of obesity [11]; integration of psychological, physical, medical, social, and economical factors [9] for reversing obesity is beyond the capacity of untrained individuals. Therefore, in order to achieve concrete results in counteracting obesity, multifaceted approaches at the individual level will be necessary. In this direction, we believe that a positive behavior change via acquiring individual self-management ability will be critical to reverse the rising tide of obesity. In particular, individuals incorporating diet and exercise programs will be able to successfully and efficiently achieve their goal. In this study, we promote an intervention study that adopts a new conative program consisting of dietary and exercise education, and incorporating individual self-management. During the 12-week education period, we focused on offering knowledge to encourage behavior change regarding diet and exercise, without demanding subjects to follow a strict regimen specified by the program. With our systemic protocol, subjects were able to control their dietary and exercise behavior, and subsequently showed considerable improvement in their obesity states and reduction

Parameter	Year	Baseline	After 12 weeks	%Difference
WC (cm)	2011	98.7 ± 7.0	88.4 ± 6.8	-10.4*
	2012	98.6 ± 5.6	87.1 ± 7.02	-11.7*
	Total	98.7 ± 6.2	87.7 ± 6.9	-11.1*
SBP (mmHg)	2011	133.6 ± 14.0	116.3 ± 9.0	-12.9*
	2012	128.4 ± 14.5	115.8 ± 11.0	-9.8*
	Total	130.6 ± 14.4	116.0 ± 10.1	-11.2*
DBP (mmHg)	2011	89.3 ± 9.0	76.4 ± 7.2	-14.6*
	2012	87.9 ± 8.6	79.5 ± 10.5	-9.6*
	Total	88.5 ± 8.7	78.2 ± 9.3	-11.6*
FPG (μU/mL)	2011	100.8 ± 15.4	92.1 ± 10.2	-8.6*
	2012	97.8 ± 12.1	90.3 ± 9.2	-7.6*
	Total	98.9 ± 13.3	91.0 ± 9.6	-9.7*
HDL-C (mg/dL)	2011	50.4 ± 10.7	58.8 ± 11.1	-16.5*
	2012	49.5 ± 9.4	54.7 ± 11.1	-10.5*
	Total	49.8 ± 9.8	56.2 ± 11.2	-12.9*
TG (mg/dL)	2011	180.8 ± 129.1	70.9 ± 21.0	-60.6*
	2012	167.6 ± 100.3	83.9 ± 63.9	-46.7*
	Total	172.1 ± 110.6	82.6 ± 52.9	-11.6*
MS (number)	2011	2.58 ± 0.71	0.50 ± 0.72	-81.4*
	2012	2.39 ± 1.17	1.00 ± 1.09	-58.2*
	Total	2.47 ± 1.00	0.79 ± 0.98	-68.0*

Values are presented as the group means ± SD. Significant difference was denoted (*p<0.05). Abbreviations: WC: Waist Circumference; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; FPG: Fasting Plasma Glucose; HDL-C: High Density Lipoprotein Cholesterol; TG: Triglyceride; MS: Metabolic Syndrome.

Table 3: Changes in risk factor of metabolic syndrome before and after the 12-week program.

of risk factors for metabolic syndrome during the two consecutive years. We recognize that these optimal results are obtained through abilities acquired during this program, such as a broader perspective and improved acumen about obesity management. Our new approach showed effectiveness and methodical convenience for the public. In fact, it may be not surprising that the subjects achieved better results during the program, since they had lacked an understanding about the optimal approach for prevention and management of obesity. We also noted that although our program obtained extraordinary results, it did not bring out remarkably different outcomes as compared to those of other intervention studies. Nonetheless the results obtained in this study are of value, since after acquiring basic and essential knowledge about diet and exercise, including the need for behavior modification, during a short period of education subjects achieved optimal results of their own volition.

Difference between previous programs and our current program

This study was predicated on the observation that previous dietary restriction and imprudent exercise to counter obesity are difficult goals to sustain for the general population. Our systemic protocol is intended to implement an established program based on dietary and exercise guidelines that were already in place, and to further apply individual self-management education.

Health authorities have provided theoretical and practical guidance to present clearly and compendiously facts and figures of the obesity epidemic [17,21-23]. However, such high level of information may be more likely to confuse rather than help people. We reasoned that obese individuals have to spend considerable time and effort to select, interpret, and apply the appropriate strategy suited to their needs. Also, it is necessary to promote such an approach to the general public. A society level strategy needs to be simple and inexpensive to be effective [20]. This is an important consideration where the ultimate goal is to conquer the epidemic of obesity.

Our approach was applied to the public through practical education designed to help participants acquire the self-management techniques needed to obtain a conative health behavior change. There are four main goals for obesity management ability: the first is maintenance of a high level of physical activity, safely; the second is the spontaneous intake of a low-energy balanced diet; the third is active monitoring and evaluation of obesity and health condition; and the last is the acquisition of various basic information to understand guidelines and gain a clear distinction of the appropriate strategy for an individual's circumstances. We believe that this ability contributes to improved self-confidence and self-respect, subsequently leading to the achievement of successful results.

Current program benefits individual self-management ability

Although obesity-related new technology development offers the potential for a more effective treatment, it is of little help without a fundamental modification in lifestyle. As most obesity issues originate from impaired lifestyle, treatment of obesity needs to preferentially account for lifestyle behavior modification combining diet and exercise [28]. Without a doubt, exercise is an essential part of life for maintaining good health and mind. Strong evidence is accumulating for the therapeutic benefits of exercise, which is being increasingly advocated by leading health authorities [29]. Despite this, obese people have problems of fear of injury, and low self-efficacy in respect to a novel or unfamiliar exercise mode or increased exercise. It is mostly from low self-esteem that obese individuals tend to avoid exercise [30]. Thus, in order to avoid such physical and psychological injuries, individuals need a steady plan and management technique. In our approach, subjects attended a 12-week exercise education program for two consecutive years. We recommended subjects an exercise, which can be done with few restrictions, such as walking and jogging, and demonstrated basic training method such as stretching and resistance training using their bodies. The subjects were free to determine the type, intensity, and duration of exercise based on their own judgment, and skilled exercise trainers helped them by giving professional advice.

In addition to exercise, correct dietary intake is essential in counteracting obesity. A growing number of studies emphasize the importance of the reduction of energy intake for weight reduction [31,32]. However, improving dietary intake means maintaining energy balance, not just targeting a reduction of energy intake. Many researchers warn of risks such as unbalanced energy intake and excessive reduction of energy, and also report the difficulty of maintaining the dietary status [33,34]. Here, we focused on conveying basic and essential knowledge related to dietary modification with energy balance to subjects via sessions of lectures and practice. Through this approach, we expected subjects to acquire an ability to control various obstacles related to dietary behavior specific to their own conditions. Based on these two methods, our program obtained good results.

Conclusion and Future Prospects

The overall results from our new public approach show that improving individual self-management ability through the current protocol significantly reduced dietary intake and increased physical activity. Such results are very meaningful because of the proactive approach demonstrated by individual participants. For example, table 2a showed significant improvement in obesity conditions, especially -12.9% weight reductions. A recent review has reported that weight reduction of 5%-10% of the initial body weight is recommended for

alleviating obesity-related metabolic abnormalities [35]. Subjects achieved in excess of this criterion via our program during the short 12-week term. Acquiring individual Self-management ability, with greater-than-recommended beneficial effects, also led to significant reduction of risk factors for metabolic syndrome (Table 3). These are related to the pathology of obesity-related diseases such as hypertension, dyslipidmia, type-2 diabetes, and consequently, CVD. An improvement in these components may be helpful in reducing these diseases. Based on the obtained data, the methods and delivery of our new public approach are acceptable. Our study demonstrated individual Self-management ability and deduced its beneficial results. This leads us to report our program as having high potential for obesity management as a new practical approach for public health.

Nevertheless, our study is only a small step forward in tackling the obesity epidemic, and there are limitations to be overcome. It should be noted that we did not conduct follow-up research to check the maintenance and progress of the accomplishment achieved with individual self-management ability. It is likely that some subjects were highly dependent on that support and supervision and had not developed the skills and routines necessary to continue to succeed independently. In the current study, although we could not evaluate these possibilities, it is important to establish and prepare for future challenges.

Conflict of Interest

The authors declare that they have no competing interests

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