A WEIGHT-LOSS PROGRAM FOR MEDICAL STUDENTS IN THAILAND: AN EVALUATION OF RELATED KNOWLEDGE, PREVAILING ATTITUDES, AND PROGRAM OUTCOMES FOR WEIGHT LOSS

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Abstract. Millions of people, worldwide, struggle with being overweight or obese. Medical students, who will eventually become physicians, should be good role models for patients; however, some medical students are themselves overweight or obese. The aim of this study was to evaluate the efficacy of a weight-loss program for medical students in Thailand. A six-month weight reduction program was designed consisted of three full-day sections that were scheduled, as follows: Day One, End of Week One, and End of Week Eight. The interventions incorporated various behavior modification strategies. Participant anthropometric measurements were recorded. Obesity-related knowledge, perception, attitude, and inappropriate weight-loss behaviors were obtained by validated questionnaire. At the end of the study, statistically significant weight loss was demonstrated (median 2.70 kg, $p<0.05$) compared to baseline. Moreover, participant knowledge significantly increased and inappropriate weight-loss behaviors significantly decreased ($p<0.05$ and $p<0.05$, respectively) compared to baseline. Given the demonstrated modest effectiveness of this low-intensity weight reduction program, this intervention should be considered as an effective education tool for medical students.

Keywords: health belief model, medical student, obesity, overweight, weight loss

INTRODUCTION

Obesity has evolved into a major global public health problem. In 2014, 39% of adults worldwide aged 18 years or older were classified as being overweight. The prevalence of obesity is 11% in men and 15% in women. Obesity is also a strong modifiable risk factor for non-communicable diseases. A global target for the prevention and control of non-communicable diseases that was declared by WHO in 2014 included a need to halt the global rise in obesity (WHO, 2014).

Physicians, a subset of the population who most would consider disinclined to becoming overweight or obese, have also been affected by this worldwide increase in body weight. One study showed that overweight or obese physicians are less confident in engaging in obesity-related counseling with patients than physicians with normal body mass index (BMI) (Hash *et al*, 2003). The weight status of physicians was also shown to affect the pattern of

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obesity care that physicians delivered to obese patients (Bleich *et al*, 2012) and patient receptiveness to obesity-related care. Moreover, many medical students were found to be overweight or obese (Boo *et al*, 2010; Gopalakrishnan *et al*, 2012).

Lifestyle modification interventions play an important role in weight reduction. Several previous studies demonstrated the benefit of weight loss using behavior modification programs in established noncommunicable diseases patients, high-risk populations, and low-risk population (Knowler *et al*, 2002; Avenell *et al*, 2004; Douketis *et al*, 2005; Cui *et al*, 2015). According to a guideline published by the American Heart Association (AHA) (Jensen *et al*, 2014), comprehensive lifestyle interventions should be implemented in overweight or obese people. Comprehensive lifestyle programs use behavior modification strategies to assist participants in adhering to a low-calorie diet and supporting increases in physical activity. These programs are normally lengthy and time-intensive (≥14 sessions within a 6-month period). While time-intensive programs are more costly to operate, those costs were found to be reasonable and justified in high-risk groups (Herman *et al*, 2005; Jacobs-van der Bruggen *et al*, 2009).

The aim of this study was to evaluate the benefit of a weight-reduction program regarding weight loss and changes in knowledge and attitude regarding weight loss among medical students. We expected that this program might be useful for medical students, which have different characteristics, settings, and environments in previous weight-reduction studies.

MATERIALS AND METHODS

Study methodology

This study was a quasi-experimental study without a control group. The study period was for six months, from 21 December 2014 to 21 June 2015. Inclusion criteria were as follows: 1) participants must have been current medical students of the Faculty of Medicine Siriraj Hospital, Mahidol University; 2) aged more than 18 years; and 3) body mass index (BMI) calculated from weight in kilograms divided by square of height in meters greater than 23 kilograms per meter squared.

Participants with the following history or conditions were excluded: heart failure, myocardial infarction, structural heart abnormality, cardiac arrhythmia, disorder of aorta, severe hypertension, eating disorder, and/or injury from exercise within the previous three months. This study was not a part of an MD degree.

Procedure

Thirty medical students were recruited for this study. Subject weight and height were measured and recorded by certified personal trainers. Knowledge and attitude relating to weight and weight loss were assessed by a questionnaire that we developed and that we had validated for internal consistency and reliability. To ensure internal consistency, a pilot study was conducted from which the questionnaire had Cronbach's coefficients of 0.70-0.90 for each module (Buraphat *et al*, 2016).

All anthropometric procedures followed standard protocols as prescribed by the Centers for Disease Control and Prevention (CDC, 2007). Participant waist circumference was measured using a stretch-resistant tape. For height measurement, a height chart (NAGATA® BW-1110H; NAGATA, Tainan, Taiwan) was used. An electronic weight scale (SEKURE® BY-828, EMPRO, Bangkok, Thailand), which displays weight in 1 decimal place, was provided for partici-

pant use in all applicable medical student dormitories.

The primary outcome of this study was decreasing participant body weight. The secondary outcome involved changing and improving the weight-related knowledge and attitude of participants. We also monitored inappropriate weight-loss behaviors via a self-reporting questionnaire.

Study subjects were given free access to the faculty's fitness center (the Siriraj Fitness Center); twenty-four free visits per participant. For participants that used up their 24 free fitness center visits, a 10% discount was offered to those intending to continue using the fitness center for the duration of the study period. In addition, all participants received an e-book, which contained information about nutrition, calculation of caloric intake, food exchange list, exercises, and mood and mind management. Each participant also received a waist tape measure and a logbook to record his or her diet and health data each week. Participants were instructed in how to use the waist tape measure in accordance with study protocol. Medical students received no monetary or school-related benefit for participating in this study.

A lifestyle modification intervention to assist participants in losing weight and learning more about related aspects and processes were divided into 3 sessions for 6 hours/session. One week and one day before each session, participants were contacted via phone, social network, and/or online message. If participants failed to join a session, an explanation for the failure to attend was requested.

The first session was held on the first day of the 6-month weight-loss program and was largely introductory in nature. Participants were instructed in how to use the logbook to record personal information, including body weight (BW), height, waist circumference, diet, exercise, and emotions. Participants were instructed on how to measure waist circumference, weight, and height, per the study protocol. We instructed participants that all three of these measurements should to be measured and recorded at least once per week by themselves.

We also used the 2013 AHA/ACC/TOS guideline for the recommended management of overweight and obese adults (Jensen *et al*, 2014) to guide participants in setting a weight-loss goal of losing at least 5% of their baseline weight. We informed participants that the first three participants who had lost the most weight at the end of the study, which was calculated in percentage, compared with the other participants would be declared the champions and were awarded the privilege of using the Siriraj Fitness Center free-of-charge for a limited time as a reward.

In addition, we provided lectures about obesity, dietary choices, nutrition, and calorie counting by experts in obesity and nutrition. We advised all participants to record what they ate, including food exchanges and calorie counts. Participants were further advised to decrease intake of sweet and oily foods and increase intake of fruits and vegetables. These dietary changes would have the effect of reducing overall calorie intake by at least 500 kcal/day or restricting overall daily calorie intake by 1,200-1,500 kcal/day for women and 1,500-1,800 kcal/day for men.

Participants engaged in discussions regarding problems associated with weight loss and solutions to those problems were presented. At the end of the first

intervention, participants were presented with hypothetical, challenging weight-loss scenarios and were asked to propose solutions to those potential problems.

The second session was held at the end of the Week 1 and consisted of group therapy, group and individual counseling, and lectures about nutrition and exercise by experts in obesity and nutrition. Discussions included challenges and solutions associated with losing weight. After the second intervention, common weight-loss problem scenarios were presented for participants to solve. Timely and accurate recording of personal information into the study logbook was emphasized.

The third session was held in Week 8. Participants were given advice individually and in groups by nutrition experts regarding the effects of eating sugar and fat, general facts about nutritional labeling, and ways to exercise effectively. There was also a self-evaluation activity, in which each participant had to self-evaluate his or her performance, identify areas that require improvement or correction, and learn techniques for minimizing or eliminating negative attitudes. Subjects also participated in a discussion that allowed them to brainstorm, express their thoughts, and to describe their experiences and problems during the study with other participants. Participants were reminded about keeping accurate track of their food intake and health status throughout the study.

The total follow-up time was 6 months. Participants' body weight, BMI, knowledge, attitude, and inappropriate weight-loss behaviors were followed-up at the 2nd, 4th and 6th months, with the first day of the program considered baseline. Participant knowledge and attitude regarding weight, weight-loss, and associated factors was evaluated by questionnaire. All data were categorized into descriptive analysis or statistical analysis according to the distribution pattern of the data. All data analyses were conducted using SPSS Statistics® (version 18.0, IBM, Armonk, NY). A p-values ≥ 0.05 was considered statistically significant.

Missing body-weight data were manage by one or the other of the following methods: a) calculate only participants who had no missing data, or b) calculate missing data using last observation carried forward imputation (LOCF) or linear regression imputation.

Ethical considerations

The Siriraj Institutional Research Board (SIRB) approved this study protocol [Ref Nº EC645/2557 (EC4) Si653/2014, 2014 Nov 11]. After enrollment in the study, participants reserved the right to withdraw at their own discretion. All participants received the same weight reduction interventions. Written informed consent was obtained from all participants.

RESULTS

Demographic data

According to the results of the Shapiro-Wilk test, the data in our study was not normally distributed. As such, nonparametric tests, such as median, interquartile range (IQR) and Wilcoxon signed-rank test were used. There were 30 participants in this study, consisting of 8 women (26.7%) and 22 men (77.3%). Median age of participants was 21 years. Median body weight was 73.0 kg and median BMI was 24.93 kg/m^2. For education level, 10 participants were second-year medical students (33.3%), 10 were third-year medical students (33.3%), and 10 were fourth-year medical students

Table 1
Weight outcomes of participants.

Statistical method	Median of weight (kg)			
	Baseline	2nd month	4th month	6th month
Complete weight record participants (*n*=17)	71	71[a]	70[a]	70.3[a]
Missing-data imputation using linear regression (*n*=30)	73	71.9[a]	70.3[a]	72.5[ab]
Missing-data imputation using LOCF (*n*=30)	73	72.5[a]	72.9[a]	72.5[ab]

[a]$p<0.05$ (Wilcoxon signed-rank test, compared to baseline weight). [b]Imputation methods were not applied for 6th month because data at 6th month were completed.

(33.3%). Participant attendance rates for the first, second, and third intervention sessions were, as follows: 23/30 (76.7%), 9/30 (30.0%) and 4/30 (13.3%), respectively.

Main results

The primary outcome involved measurement of body weight and calculating change in body weight. Complete weight record participants (*n*=17) defined as participants complete reported their body weight at baseline, the 2nd, 4th, and 6th month to investigators. There was a significant decrease in participant body weight in complete weight record participants group when compared to initial body weight at the 2nd, 4th, and 6th month using Wilcoxon signed-rank test ($p=0.002$, $p=0.002$, and $p=0.001$, respectively). Missing-data imputation using LOCF (Last Observation Carried Forward) and linear regression showed a significant decrease in participant body weight at the 2nd and 4th month, as compared to baseline ($p<0.005$). Linear regression model yielded a high *R* square value (0.937; $p<0.005$). When we compared baseline data to post-intervention (at 6 months) data without the use of any imputation method (*n*=30), the median of individual participant difference in body weight was 2.70 kg (IQR = 3.00 kg). There was a significant decrease in participant post-intervention body weight when compared to initial body weight without any imputation method (*n*=30, $p<0.001$ by Wilcoxon signed-rank test). Twenty-four of 30 participants (80.0%) decreased their body weight after completing our six-month study (Table 1).

We analyzed participants' knowledge who had not had missing data (*n*=23). Comparing baseline data and data collected at the end of the study, we found that participant knowledge regarding body weight and weight loss significantly increased and that inappropriate weight loss behaviors significantly decreased (Table 2).

We observed participants, conducted a directed interview, and asked open-ended questions during each of the three intervention sessions. Most participants stated that they had a better understanding of the struggle that patients experience in attempting to lose weight. They suggested that physicians should have more empathy with obese patients. Moreover, they learned that general nutrition recommendations are not easy to implement in daily life. One said, "Although I am a medical student, I was not able to

Table 2
Median participant knowledge and attitude scores before and after the intervention, and Wilcoxon signed-rank test results (N=23).

Parameters (score range)	Before intervention (%)	After intervention (%)	p-value
Knowledge (5-75)	66 (88.0)	72 (96.0)	0.015[a]
Perception of seriousness (5-25)	22 (88.0)	23 (92.0)	0.615
Perception of susceptibility (5-25)	19 (76.0)	20 (80.0)	0.292
Perception of benefits (5-35)	32 (91.4)	32 (91.4)	0.739
Perception of barrier (5-75)	47 (62.7)	47 (62.7)	0.896
Cues to losing weight (5-25)	18 (72.0)	19 (76.0)	0.129
Self-efficacy (5-30)	20 (66.7)	23 (76.7)	0.336
Inappropriate weight loss behaviors (5-45)	13 (28.9)	10 (22.2)	0.014[a]

[a]Statistically significant (p<0.05).

memorize the food exchange list and the related calories per unit. Once I remembered them, I found it very complicated to calculate the calories per serving for a meal." Another said, "I now understand how patients struggle in their attempt to lose weight." One participant at the third session said, "At first I thought weight reduction was easy, but now I recognize that it is hard to maintain body weight after my weight is reduced."

DISCUSSION

We designed a new weight-loss intervention for medical students that required minimal time investment by participants over the course of the 6-month program. Our results suggested that medical students who participated in this study lost approximately 2.70 kg of body weight in 6 months. One prior study demonstrated that a standard cognitive behavioral weight-loss intervention plus reward when participants completed each goal could reduce body weight in healthy volunteers (Byrne *et al*, 2012). Our study indicated modest weight reduction using a less time-intensive weight reduction program, similar to previous study. From a health belief model, modification of behaviors is facilitated by changes in knowledge, underneath cognitive, and external factors.

Changes in knowledge alone do not produce behavioral changes (Daddario, 2007; James *et al*, 2012; Kim *et al*, 2012). Among all assessed components, statistically significant improvement was observed for only knowledge and inappropriate weight loss behaviors. This may be due to the relatively small sample size used in our study. Moreover, some parameters of perceptions measured by the questionnaire had high initial scores; thus, the ceiling effect may have influenced some statistical outcomes.

Interestingly, directed interviews during and after interventions reflected participant attitudes. Study participants learned by doing. These results may provide evidence that participants experienced change at the cognitive level, but could not demonstrate in quantitative methods. One previous study showed that medical students received their own experiences and changed their attitude toward their own health and patients after

participating in a weight-management program (Schmidt *et al*, 2013). Our descriptive results from observations and interviews revealed that participants were empathetic towards the struggles that patients face and experience when trying to lose weight.

Although these results were not collected in quantitative methods, they implied that participants experienced an internal change regarding their perception about the weight-loss process. This intervention may be used as an educational tool for medical students to learn what patients think and feel when they are attempting to lose weight. Even though this question was not answered by our research, it should be explored in the future. In primary care settings, physicians who have more obesity-related knowledge and a positive attitude toward weight loss are more likely to provide effective obesity management to patients (Salinas *et al*, 2011).

Improvements in related knowledge and attitudes regarding weight and weight loss among medical students while studying in medical school may improve the quality of the care that they provide to obese patients in the future. Future research should focus on the attitude of medical students regarding their perception of how to deal with obesity patients. Long-term follow-up should be conducted to evaluate whether the quality of their patient care and obesity management in real practice improves or not.

This study has some limitations. First, this was not a randomized controlled study. As such, there was no control group with whom to compare actual effects of an intervention. Weight reduction for this study might be influenced from others confounders. Second, a small reduction in body weight may not be clinically significant. This intervention may not be appropriate as a clinical tool for weight reduction or for reducing cardiovascular risk. However, the less time-intensive intervention that we used in this study improved participant knowledge regarding body weight and weight loss and decreased inappropriate weight-loss behaviors. Third, interview results from each session were collected using a qualitative method, which may have led to unavoidable bias in some instances. Finally, only 56.7% (17/30) of participants completed their body weight record. Imputation methods might over or underestimate efficacy of the intervention.

A less time-intensive weight reduction program was suggested to reduce the body weight of medical students. Moreover, weight-reduction knowledge was increased and inappropriate weight-loss behaviors were decreased among subjects after participating in the study. This weight-loss protocol might be considered as an effective education tool for medical students.

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