Testing an Internet-Based Turkish Obesity Behavioral Therapy Program: A Randomized Study

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SUMMARY

Objective: Behavioral treatment is recommended as the first line intervention for the prevention of health problems pertaining to obesity. Internet-based programs are used to provide cognitive behavioral therapy for psychiatric disorders and systemic diseases to a large number of patients at low cost. The aim of this study is to develop the first internet based Turkish obesity behavioral therapy program and test its short-term effectiveness.

Method: A Turkish web-based behavioral therapy program based on the behavioral strategies employed in the Diabetes Prevention Program was generated. In order to test the effectiveness of this internet-based program an eight week randomized study was conducted. A total of 101 overweight participants with body mass index in the 25-40 range were randomly assigned to an eight-week weight loss program using either the Internet Behavior Therapy (IBT, n=51) or e-mail education (EE, n=50). The participants in the IBT group were provided access to an Internet program that provided videos teaching behavioral weight-loss skills as well as a self-monitoring platform to calculate the daily calorie balance. The participants in the EE group received weekly e-mails with information on healthy eating, physical exercises and weight loss for eight weeks. The primary outcome measure was the observed weight change at the end of the 8 weeks.

Results: In the analyses wherein baseline weight was carried forward for missing data, the IBT produced significantly larger mean weight loss in comparison to the EE at the end of the 8 weeks [2.28 kg (2.11) vs. 0.74 kg (1.57), p=0.001]. The participants in the IBT group, when compared to the EE group, were also more likely to achieve a clinically significant weight loss of 5% of their initial body weight at the end of the 8-week study period (17.6% vs. 2%, p=0.016).

Conclusion: The participants who received a structured IBT intervention lost significantly more weight after two months, compared to those who received weekly informational emails regarding weight loss. Internet-based behavioral therapy programs may have the potential to serve as a low-cost alternative for obese patients.

Keywords: Obesity, weight loss, behavior therapy, internet

INTRODUCTION

Developments in electronic psychiatry (e-psychiatry) programs with the aim to increase access to mental health services has gained momentum in recent years. Internet-based cognitive behavioral therapy methods are used in the treatment of psychiatric disorders such as depression, anxiety disorders, obsessive-compulsive disorder, as well as chronic diseases requiring a multidisciplinary approach such as obesity and diabetes (Hutchesson et al. 2015, Kumar et al. 2017).

Obesity is a public health problem with increasing prevalence in our country as well as in the world. In the "Turkish Epidemiology Survey of Diabetes, Hypertension, Obesity and Endocrine Disease (TURDEP - II)" study conducted in

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2010, the prevalence of obesity in our country was reported to be 27.3% for males and 44.2% for females (Satman et al. 2013). These results indicate an increase of 107% among males and 34% among females as compared to the results of the TURDEP I study conducted in 1998 (Satman et al. 2002). Obesity patients are under increased risk of heart disease, diabetes, hypertension, hyperlipidemia and various cancers (World Health Organization 2000). Body weight loss of 5% or more is considered to be significant for reducing these complications (Williamson et al. 2015). Apart from biological and environmental factors, psychological and sociocultural factors also contribute to the development of obesity. Personality traits such as reward sensitivity and impulse control skills affect the eating behavior and energy balance of individuals in environments with easy access to high-calorie foods (Fischer and Munsch 2012). Various psychological characteristics such as stress sensitivity, depression symptoms, skills in emotion regulation and problem solving are also significant in the development of obesity (Luppino et al. 2010, Munsch et al. 2012, Wadden and Foster 2000).

The behavioral therapy for obesity aims to determine and improve the patient's eating, moving and thinking habits that contribute to his/her weight problem (Jones and Wadden 2006). This therapy is based on identifying the stimuli which increase the patient's food intake and promoting the positive behaviors enabling appropriate responses to these. Cognitive processes that make it difficult to lose weight are investigated with the patient during therapy. The objective is for patients to set realistic goals, evaluate the process in a realistic way and learn to correct inaccurate thoughts when they fall behind the goals. (Wadden and Foster 2000).

In addition to examples of distorted thoughts such as all-or-nothing thinking and catastrophic thinking, the rigid relationship between body appearance and self-esteem is discussed. Behavioral therapy aims to help the patient to realize his or her inaccurate thoughts and develop alternative thoughts and behaviors.

Behavioral treatment is recommended as the first line of intervention for overweight and obese individuals (Butryn et al. 2011). The therapy is usually implemented with groups of 10-15 individuals on a weekly basis for 3-6 months. One of the most successful examples of behavioral weight loss therapy is the multicenter Diabetes Prevention Program in the United States (Knowler et al. 2002). In this study, 1079 overweight patients with impaired glucose tolerance were included in a behavioral therapy program lasting 16 weeks, resulting in mean weight losses of 7 kg and 3 kg , respectively, in the first and the third years. There was a 58% decrease in the risk of type 2 diabetes in the therapy group compared to the control group. The cost per person of this three-year study was $2,780. In the same study, the cost per person in the metformin group without behavioral therapy was $2.542 and the decrease in type 2 diabetes risk was 31% (Hernan et al. 2003). The training program and materials distributed to the participants are free for non-commercial use (https://dppos.bsc.gwu.edu/). In comparison to pharmacological and surgical methods, using behavioral therapy is relatively more cost effective and without any distinct side effects. However, majority of those who could benefit from behavioral therapy cannot gain access to it as the number of the trained qualified healthcare staff is very limited and the method requires regular attendance to the weekly clinical interviews. Since the early 1990s, alternative methods are therefore being explored for providing more accessible weight loss programs for obesity treatment (Jeffery et al. 1990, Tate et al. 2001). Given the potential of reaching a large number of individuals at low cost, the internet has interested the researchers in the last 20 years in especially the USA and Europe (Levine et al. 2015).

In 2001, Tate and colleagues published the first study showing the success of a web-based behavioral weight loss program (Tate et al. 2001). Afterwards, many different studies have been conducted on the use of internet in weight loss. Differences in the program contents and study patterns were also reflected in the success rates; with reports of weight losses in the 1.3-7.6 kilogram range (Arem and Irwin 2011, Levine et al. 2015, McTigue and Conroy 2012, Neve et al. 2010, Reed et al. 2012). On the other hand, typical weight losses of 6-10 kilograms were reported by the face-to-face conducted behavioral treatment programs (Wadden et al. 2007). Although not equally successful as the face-to-face methods, the internet based behavioral therapy methods have the advantages of reaching many more patients at much less cost (Thomas and Bond 2014). The increased effectiveness of these programs aided by the fast development of the internet and video technologies raise the expectation of being available as a primary healthcare service on a very wide scale (Thomas et al. 2015)

Although there have been studies showing the effectiveness of internet-based behavioral weight loss programs in different cultures and languages, to our knowledge, a randomized trial to evaluate a de novo program in the Turkish language adjusted to the local cultural characteristics has not yet been reported (Kozak et al. 2017, Kumar et al. 2017, Beleigoli et al. 2019). The aim of this study is to develop the first internet-based behavioral weight loss program in the Turkish language and to evaluate its effectiveness in the short term.

METHOD

Development of Internet-Based Behavioral Therapy Program

To be tested in our study, we have developed an internet-based behavioral therapy program suitable for sociocultural characteristics of people living in Turkey. The structure

of the program is based on strategies used in the Diabetes Prevention Program (Knowler et al. 2002). The content of the therapy program was prepared in collaboration with three psychiatrists, an endocrinology and metabolic diseases specialist, a dietician and a sports science specialist.

The program consists of sub-programs on nutrition and exercise. A total of 69 graphics-enriched videos with a mean length of 5 minutes were prepared for the nutritional program which provided participants with information on healthy eating, self-monitoring, control of environmental stimuli, coping with emotional eating behavior and coping with slips. For the exercise program, 145 videos showing the exercises that can be done at home without the use of any tools and a calendar showing the performance of the exercises with increasing intensity were prepared. At the end of each week, various assignments were given to the participants to practice what they learned that week. With these trainings, it was aimed that the participants gain new habits such as healthy eating, exercising and changing the environment. The web-based program included, in addition to the educational videos, a self-monitoring tool, the ''food diary',' to follow up on the daily calorie intake and change in body weight.

Participants

Approval of the Clinical Research Ethics Committee of Ege University Faculty of Medicine was obtained for undertaking this study. In order to recruit participants in the 18-65 year age range with body mass index (BMI) of 25-40 and regular access to the internet, web-based advertisements of the e-mail address of the program and posters in the Ege University Faculty of Medicine Hospital were used. In order to evaluate the participant compatibility with the study, 197 individuals who applied for the program and provided their contact information were interviewed on the telephone. Potential participants were excluded if they were pregnant or planning a pregnancy, had an uncontrolled medical illness (diabetes, hypertension, hypothyroidism, etc.), were currently in another weight lose treatment, had lost 10% or more of their body weight in the last 6 months or were using appetite suppressant drugs .

Study Groups

The 101 participants meeting the inclusion criteria of the study were assigned to two groups by computer generated gender stratified permuted block randomization; whereby the internet behavioral therapy (IBT) group and the e-mail (EE) group consisted of 51 and 50 individuals, respectively.

Study Design

All participants were examined at the outset and the second month of the study for height, weight and waistline circumference measurements. The participants gave informed consent at the initial visit and they were trained on how to reach the target of losing 0.5-1 kilogram body weight per week and to calculate the daily calorie intake. All participants were explained the basic principles of following up daily calorie intake, physical activity level and body weight.

Procedures Specific for the Internet Behavioral Therapy (IBT) Group

The participants of the IBT group, unlike those in the EE group, were allowed access to the internet-based behavioral therapy program (Figure 1). During the initial visit, the participants were taught how to reach the internet-based program with their own user name and password; and they were demonstrated on the computer how to watch the videos of the weekly lessons and how to use the food diary page. Throughout the eight-week program, the participants were given feedback on their performance of watching videos and filling their food diary through the in-program message system. Participants who did not log in to the program for a week were sent reminder e-mails.

Procedures Specific for the Educational E-mail (EE) Group

After the initial visit, weekly informative e-mails were sent to the participants in the EE group for 8 weeks. The contents of these e-mails consisted of general information on healthy eating, physical exercise and weight loss. Thus, this group was intended to represent the recipients of the routine outpatient service recommending patients to lose weight and providing general information

Data

At the beginning of the study, the demographic details, clinically diagnosed diseases and the prescribed drugs of the participants were recorded. The primary outcome of the study was the change in body weight at the end of 2

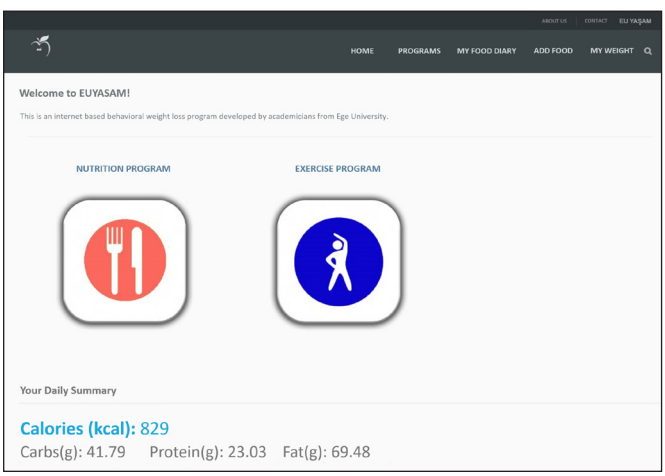

Figure 1. A Screenshot from the Homepage of the Internet-based Behavioral Therapy Program (Translated into English for the Article)

months. This change was recorded in both kilograms and percent of initial weight. Weight was measured by the study staff on a digital scale at the baseline and the second month with the participants in indoor clothes and without shoes. Height was measured using a wall-mounted stadiometer. Waist circumference was measured at umbilicus level. The secondary outcome was the level of adherence to the internet program by the IBT group, which was measured by recording the number of videos watched by each user and the number of entries made to the food diary in the internet program.

Statistical Analysis

Data analyses were made on the Statistical Package for the Social Sciences, version 20 (SPSS.20 for Windows, SPSS, Chicago, IL). The χ^2 test and Fisher's exact chi-square test were used to evaluate the categorical variables such as gender and educational background. Numerical data were examined for normality of distribution by kurtosis and skewness values and by the Kolmogorov-Smirnov test. Mean values of the normally distributed numerical data were compared using the Student's t test. In the cases where this test could not be applied, the Mann Whitney U test was used to compare the means. Using the initial body weight as a covariate, the covariance analysis (ANCOVA) was used to assess the difference between the weight losses of the groups. Since the data on the number of videos watched and the number of the diary entries made by the users were not normally distributed, the relationship between these variables and weight loss was examined by the Spearman correlation analysis. In all evaluations, a p value of <0.05 was considered statistically significant. This study was designed to have 80% power to detect significant between-groups difference in weight loss of ≥5 kilograms with 100 participants.

RESULTS

The flow chart of the study is presented in Figure 2. A total of 101 participants were included in the randomization process and 75.2% of these participants completed the study by attending the last visit at the end of the second month. The trial completion incidence was 78.4% in the IBT group and 72% in the EE group and the intergroup difference was not statistically significant (χ^2=0.561, df=1, p=0.454). Age, gender, educational status and measurements of baseline body weight, body mass index and waist circumference were similar between the two groups (Table 1).

In the analyses with the baseline weight carried forward for missing data, the mean weight loss of the participants in the IBT group and the EE groups were, respectively, 2.28 (±2.11) kg 0.74 (±1.57) kg (F (1.98)=20.23, p=0.001). The percentage of the participants who lost at least 5% of the initial

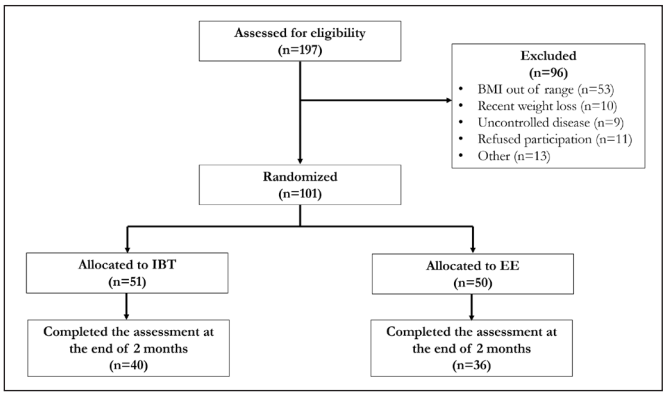

Figure 2. Participation Flow Chart of the Study

body weight was 17.6% for the IBT group and 2% for the EE group, the difference being statistically significant (p=0.016). Similarly, the average change in waist circumference was 2.51 (2.06) cm in the IBT group and 0.48 (1.68) cm in the EE group (F (1.98)=31.12, p=0.001). The mean changes in body weights at the end of the second month in both groups are shown in Table 2 and Figure 3.

Similar results were obtained in the analyses on the data of only the participants who completed the study. The mean weight loss was 2.91 (±1.96) kg in the IBT group and 1.02 (±1.78) kg in the EE group (F (1.73)=37.34, p<0.001). The percentage of participants who reached the 5% weight loss target was 22.5% in the IBT group and 2.8% in the IE group (p=0.015). The change in waist circumference was 3.2 (±1.78) cm in the IBT group and 0.66 (±1.95) cm in the EE group (F (1.73)=22.37, p<0.001). Although 78.4% of the participants in the IBT group had completed the study by attending to the last visit, only 25.4% had watched all of the 214 training videos and had followed the 8-week training program effectively. The percentage of users who did not complete watching the videos of any week was 21.5%. The percentage of users who have completed watching the videos weekly is shown in Figure 4.

Comparing the demographics of the participants in the IBT group who had watched all of the videos, i.e. ''the completers" (n=13, 25.4%) with the participants who had failed to complete the program, i.e. ''the non-completers" (n=38, 74.6%), showed that the groups did not differ with respect to age, gender and the baseline body weight, but differed significantly on educational status. The mean age of the completers was 40.92 (±9.45), with a median of 41; and the mean age of the non-completers was 39.82 (±10.235) with a median value of 37 (U=235.5, p=0.803). The percentages of females in the group of completers and non-completers were 69.2% and 84.2%, respectively (p=0.253). The mean body weight in the completers group was 87.8 (±17.69) with a median value of 79.8; and it was 87.6 (±13.27) with a median 88.85 in the non-completers group (U=233, p=0.762).

Table 1. The Demographic Characteristics and Baseline Data of the Participants

		Total n=101	Internet Behavioral Therapy n=51	Educational E-mail n=50	Test Statistics	Degree of Freedom	p Value
Age, mean (SD)		40.57 (11.01)	40.1 (9.96)	41.06 (12.07)	t= 0.437	99	0.663
Gender, n (%)	Female	80 (79.2%)	41 (80.4%)	39 (78%)	χ^2=0.88	1	0.767
	Male	21 (20.8%)	10 (19.6%)	11 (22%)			
Marital status, n (%)	Single	19 (18.8%)	11 (21.6%)	8 (16%)	χ^2=0.911	2	0.634
	Married	79 (78.2%)	38 (74.5%)	41 (82%)			
	Divorced	3 (3%)	2 (3.9%)	1 (2%)			
Educational status, n (%)	High School	22 (21.7%)	13 (24.5%)	9 (18%)	χ^2=3.408	2	0.182
	College	71 (70.2%)	32 (62.7%)	39 (78%)			
	Graduate	8 (9.1%)	6 (11.8%)	2 (4%)			
Occupational status, n (%)	Unemployed	15 (14.9%)	6 (11.8%)	9 (18%)	χ^2=1.141	2	0.565
	Employed	78 (77.2%)	40 (78.4%)	38 (76%)			
	Retired	8 (7.9%)	5 (9.8%)	3 (6%)			
Height, cm (SD)		164.98 (8.79)	164.94 (8.2)	165.02 (9.44)	t=0.45	99	0.964
Body Weight, kg (SD)		86.92 (13.85)	87.66 (14.33)	86.16 (13.44)	t= 0.542	99	0.589
Body mass index, kg/m^2(SD)		31.87 (3.94)	32.17 (4.26)	31.56 (3.6)	t= 0.777	99	0.439
Waist circumference, cm (SD)		102.67 (10.21)	103.51 (10.12)	101.82 (10.34)	t= 0.83	99	0.409

SD: Standard Deviation

Table 2. The Changes in Mean Body Weight and Mean Waist Circumference of the Participants in Internet Behavioral Therapy and Educational E-mail Groups After Two Months

	Internet Behavioral Therapy (n=51)	Educational E-mail (n=50)	Test statistics	p value
Change in mean body weight, kg (SD)	-2.28 (2.11)	-0.74 (1.578)	F (1.98) = 20.23	0.001
Change in mean waist circumference, cm (SD)	-2.510 (2.06)	-0.48 (1.68)	F(1.98) = 31.12	0.001
Participants who lost more than 5% weight, n (%)	9 (17.6%)	1 (2%)	-	0.016

SD: Standard deviation

Only university graduates and postgraduates made up the completers group, whereas 34.2% of the non-completers group consisted of high school graduates (p=0.023). A significant correlation was determined between the number of videos watched and the weight loss in the IBT group (r=0.6, p<0.001). Similarly, a strong correlation was observed between the number of food entries recorded in the system and the weight lost (r=0.72, p<0.001).

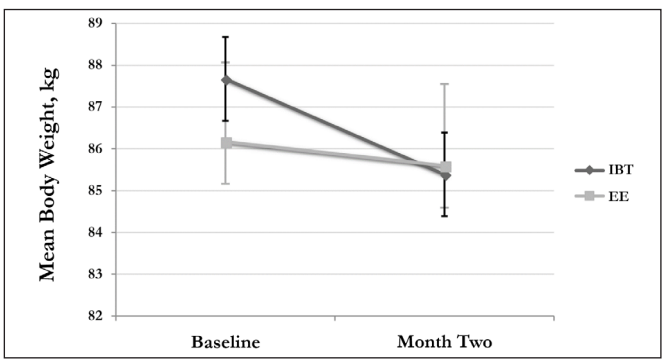

Figure 3. The Change in the Mean Body Weight of the Participants in the IBT and the EE Groups. IBT: Internet Behavioral Therapy; EE: Educational E-Mail. The Error Bars Indicate the Standard Error of the Mean.

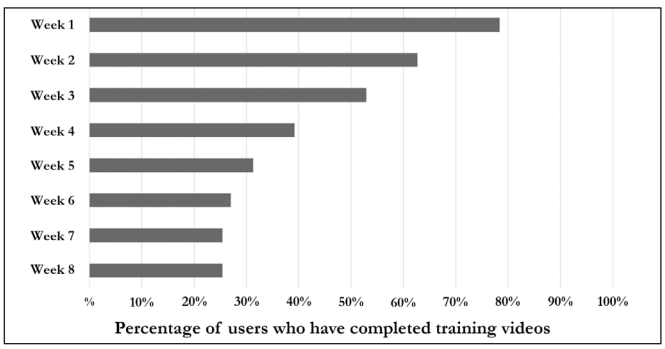

Figure 4. The Percentage of Users Who Have Completed Watching Weekly Training Videos in the Internet Behavioral Therapy Group

DISCUSSION

In this study, participants who used the internet-based behavioral weight loss therapy program lost more weight at the end of the two-month period compared to the participants who received weekly informative e-mail about weight loss and healthy living. The percentage of participants achieving the 5% weight loss target, clinically accepted as significant to reduce the complications associated with obesity, was higher in the IBT group. Although the results of our study reflect only the short-term efficacy of the program, they are promising for the development of a cost-effective alternative for the treatment of obesity.

The effectiveness of weight loss programs is directly related to the percentage and duration of the *user engagement* with the program (Thomas et al., 2008). As in previous studies, a significant positive correlation was found in our study between program engagement and weight loss, but the user engagement was relatively lower. In the IBT group 47.1% of the participants stopped following the program after the first two weeks, and only 25.4% completed the program. Although the number of participants was low, it is noteworthy that not one of the high school graduates in the IBT group completed the program. Improvement of weight loss results could be expected by improving various features in the program to increase engagement (Johnson and Wardle, 2011). For example, designing the program in a form that can attract the interest of individuals from every educational background and making it more user-friendly can increase the engagement of the users.

It has also been shown that the use of more individualized feedback and reminders increases self-monitoring behavior and the average weight loss (Hutchesson et al., 2016).

Increasing social interaction and support through the program can also increase the effectiveness. Krukowski et al. (2008) have argued that communicating with other participants and getting information about them is a key feature especially during the maintenance phase of the internet based weight loss programs. For ethical reasons of confidentiality, in our study the participants were not allowed to interact with other users. Therefore, developing the program with features that provide dynamic feedback and allow interaction with other users may increase its effectiveness. Another method that can increase engagement is to provide individual or group based communication with a therapist. In our study, users were given feedback only on the percentage of the videos watched and the food diary entries recorded in the system while other behavioral assignments were not checked by a therapist. However, it is known that interactive programs which include therapist supervision are more effective than fully automated programs (Sorgente et al. 2017).

Since the participants were selected from the volunteers applying on the internet, the data on demographic characteristics could indicate which patients are likely to be interested in internet-based weight loss programs. The mean age of the participants was 40.57 (11.01); 80% were female; 78% of the participants were university graduates and 77.2% had full-time employment. Similar features have been reported in many internet-based weight loss studies in different countries (Harvey-Berino et al. 2004, McConnon et al. 2007, Rothert et al. 2006, Tate et al. 2001; Womble et al. 2004). Similar demographic data are also found in the internet-based cognitive behavioral therapy studies for different psychiatric disorders (Birney et al. 2016, Newby et al. 2017, Oromendia et al. 2016, Romero-Sanchiz et al. 2017). The data on program use by the participants of the IBT group showed that all patients who completed the eight-week program by watching all the videos were college or university graduates. These data suggest that internet-based programs are of greater interest to individuals with higher education who would benefit from behavioral therapy but do not have the time to attend face-to-face therapy programs on account of their jobs. Further studies aiming to develop effective internet-based therapy programs can create cost-effective alternatives to be offered by the physicians to those patients who are unable to attend therapy for a variety of reasons.

The main limitation of our study is the short follow-up period. The effectiveness of the program on weight loss in the longer term remains to be assessed. Another limitation is that the study sample was small and most of the participants were educated females living in the vicinity of Ege University in Izmir. Comprehensive studies with larger groups will allow stronger analysis of the relationship between the level of the benefit from the program and differing demographic and clinical characteristics of the patients.

CONCLUSION

Studies for developing Internet-based programs in different languages for behavioral treatment of systemic and psychiatric diseases are continuing all over the world. Our study has promising results on the effectiveness of internet based Turkish programs for behavioral therapy of obesity. Developing programs with higher user engagement can provide a cost-effective alternative that physicians can recommend to obesity patients.

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