Assessing the efficacy of utilizing a smartphone calorie calculator for weight loss, body composition and body shape preoccupation

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Abstract

Objective: Recording calorie intake has been shown to assist in weight loss [1]. Today, smartphone applications enable patients to easily record calorie intake and are readily available. The purpose of this study is to evaluate the efficacy of utilizing a smartphone calorie calculator for weight loss, body composition metrics and body shape preoccupation when used alone or in conjunction with weekly email outreach to patients, encouraging them to remain compliant with a weight loss program.

Methods: In this pilot study, fourteen college-aged women were recruited for the study on a rolling basis. Their weight was recorded, and their body composition was measured with the use of a dual-energy X-ray absorptiometry (DEXA scan). Their body-shape preoccupation was evaluated by the validated body shape questionnaire (BSQ)-16A survey, a self-report measure of body shape preoccupation typical of common eating disorders [2,3]. A daily calorie goal was set for each subject based on their calculated resting metabolic rate. All subjects were instructed to use a smartphone application to record their daily calorie intake. Nine intervention subjects were emailed weekly to self-report on how many days they used the application and their daily calorie intake. They were also offered encouragement to remain compliant with the program. Each intervention subject was re-evaluated after eight weeks. Five control subjects were not contacted weekly and were re-evaluated after eight weeks.

Results: Both the intervention group and the control group showed a reduction in weight (6.52 ± 4.78 lbs vs 6.3 ± 1.18 lbs, p = 0.40) fat mass (0.23 ± 2.05 lbs vs 3.43 ± 2.99 lbs, p = 0.07), percent body fat (0.23 ± 1.11 vs 1.26 ± 0.48 lbs, p = 0.07) and visceral fat mass (VFM) (0.01 ± 0.18 vs 0.06 ± 0.22, p = 0.86). The Body Shape Questionnaire 16A (BSQ-16A) also indicated improvement in both groups for body shape preoccupation (6.14 ± 6.07 vs 18.6 ± 8.41, p = 0.19). Thus, use of the application benefitted both groups.

Conclusion: The study's results indicate that use of a smartphone calorie-counting application may have a positive effect on body composition metrics and may lower patients' preoccupation with body image-with or without an additional intervention.

Abbreviations and Symbols: kcal/day: Kilocalorie per day; NYIT: New York Institute of Technology; IRB: Institutional Review Board; BMI: Body Mass Index; DEXA: Dual-Energy X-ray Absorptiometry; BSQ: Body Shape Questionnaire; RMR: Resting Metabolic Rate; LBM: Lean Body Mass; VFM: Visceral Fat Mass; lbs: pounds; BPM: Beats per minute; mmHg: Millimetres of mercury.

Introduction

It is estimated that almost 40% of adults in the world are overweight and 13% are obese, yet the incidence of obesity is continuing to rise [4]. Maintaining a balanced caloric intake is crucial to maintaining a healthy weight. Overnutrition has led to an increasingly overweight and obese population. It is recommended that patients must lower their daily calorie intake by 500-1000 kcal/day in order to lose 1-2 lbs per week [1]. Maintaining a calorie deficit can be difficult, causing many patients to be unsuccessful in their weight loss attempts. There are several calorie-counting applications on the market designed to assist patients in reducing their caloric intake. However, many of these applications have not been thoroughly reviewed.

MyFitnessPal™ is a smartphone application marketed as a weight loss aid, which helps users record their daily calorie intake and avoid overnutrition [5]. Our study sought to evaluate the efficacy of utilizing MyFitnessPal™ for subjects who also received encouragement to remain compliant with its use. We hypothesized that subjects using the smartphone calorie calculator in conjunction with being emailed weekly to self-report caloric intake would have a greater improvement in weight loss and body composition parameters in eight weeks than those who were not contacted every week. Additionally, we hypothesized that subjects who were contacted every week would have a greater improvement in body-shape preoccupation for typical eating disorders.

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Methods

Setting and sample

A prospective, randomized, controlled pilot study was designed for college-aged females. This study was approved by the New York Institute of Technology (NYIT) Internal Review Board and all subjects signed written consent to participate. Fourteen women from the NYIT campus with a mean age of 22 years (± 2.79) were recruited via voluntary enrolment in a weight loss study. All prospective participants were asked to record their food intake for three days and were subsequently interviewed to determine whether they would be included in the study. Inclusion criteria were a) status as an NYIT student between the ages of 18-35; b) Body Mass Index (BMI) ≥ 25.0, body fat % > 33% for women. Exclusion criteria were a) pregnant females; b) use of weight loss smartphone applications within six months; c) use of weight loss inducing medication (list of medications was provided to subjects to review); d) any diagnosed gastrointestinal, malabsorptive disorder, recently administered gastrointestinal contrast or nucleotides. The fourteen women included were randomly assigned to one of two groups: five control subjects and nine intervention subjects.

Instruments

All subjects were weighed. Their body composition was measured with the use of a dual-energy X-ray absorptiometry (DEXA scan) (General Electric Luna (GE Medical Systems Lunar 3030 Ohmeda Dr. Madison, WI 53718 USA) [6]. Body composition parameters included lean body mass, fat mass, body fat percentage, visceral fat mass, and calculated resting metabolic rate (RMR).

Body shape preoccupation was evaluated by the validated body shape questionnaire (BSQ)-16A survey [2,3]. This survey consists of sixteen questions and has a maximum score of 96. A high BSQ-16a indicates a high susceptibility for an eating disorder.

Baseline calorie intake was obtained by having subjects record their food intake for three days, via a paper food log. Investigators converted each subject's food intake to a daily calorie amount using the MyFitnessPal™ application.

Investigators obtained pulse rate by measuring each subject's radial pulse for one minute and obtained blood pressure using a manual blood pressure cuff.

Procedure

The study was conducted on a rolling basis with eight-week periods set according to each subject's starting date.

Each prospective subject kept a paper food log of what they consumed for three days before the study began and submitted the logs on day one of the project period. Investigators subsequently explained the objectives and purpose of the study to all subjects. Screening interviews were conducted and admitted subjects signed consent forms for participation in the study and for radiologic evaluation.

Upon completion of all surveys, investigators recorded blood pressure and pulse, and used the DEXA scan to measure subjects' body composition. The only information shared with subjects was their DEXA scan-estimated calculated resting metabolic rate (RMR). All subjects were then instructed to download the MyFitnessPal™ application to their smartphones. Each subject participated in a five-minute training on how to use the application to record daily caloric intake. Investigators set the daily calorie goal for each subject at 300 calories above their DEXA scan- calculated RMR. Subjects were instructed to record their daily caloric intake, keeping their calculated calorie goal in mind.

Investigators made weekly email contact with the intervention subjects for the purpose of obtaining the results of their calorie logs and to offer encouragement. Intervention subjects also emailed their weekly calorie diaries to investigators, who recorded the number of days per week that subjects accurately tracked their caloric intake and the average daily caloric intake for each of those days. Subjects were also encouraged to use the application every day of the week and to keep their daily caloric intake within their set calorie goal. Subjects assigned to the control group were not contacted every week but were informed at the beginning of the study that investigators would request the same information after eight weeks.

After eight weeks, subjects were reassessed using all outcome measures (weight, BSQ-16A survey, blood pressure and pulse measurements, and DEXA scan) and informed of their body composition changes during the eight weeks of the study. Control subjects allowed investigators to independently access the MyFitnessPal™ application on each of their phones in order to obtain the number of days they accurately kept track of their caloric intake, as well as the average daily caloric intake for each of those days.

Statistical Analyses

Descriptive statistics were used to compare body composition and body shape preoccupation pre and post intervention.

Results

The primary outcome measure of this study was weight loss. The results demonstrated that both groups lost weight throughout the study, the control group lost more weight than the intervention group (3.6lbs ± 6.38) (Table 2). Secondarily body fat %, body fat mass and visceral fat all were reduced in the control group more than the intervention group (1.03 ± 1.03; 3.2 ± 2.84; 0.05 ± 0.19). Lean body mass increased in the intervention group (1.19 ± 3.31) and decreased in the control group (0.72 ± 3.63) (Table 2). Resting Metabolic Rate decreased in the control group (6.8 ± 32.66) and increased in the intervention group (10.5 ± 29.49) (Table 2). The BSQ scores decreased in both groups, with a larger decrease in the control group (12.46 ± 1.01). There was no change in pulse, systolic blood pressure, or diastolic blood pressure (Table 2).

The results demonstrated that the average calories eaten were less than the calorie goal in both groups, more in the control group than the intervention (372.61 ± 636.40). The intervention group was compliant with the food log more days per week than the control group (3.14 ± 2.22) (Table 1). Two-way t-test was performed with a significance set at $p < 0.05$

Discussion

Previous studies of MyFitnessPal™ include a randomized, controlled trial conducted out of two primary care clinics at the University of California, which evaluated the effectiveness of using the application for weight loss. Investigators divided 212 primary care patients into two groups, members of which had a body mass index greater than or equal to 25 kg/m. One group received traditional primary care alone while the other group received traditional primary care and were encouraged to use MyFitnessPal™ to record calorie intake. After six months, there was no difference in weight loss between the two groups. Interestingly, Body Fat Mass and Body

Table 1. Subject Compliance

	Control			Intervention			
	Pretest	**Posttest**	**Change**	**Pretest**	**Posttest**	**Change**	***P* value**
Average calories eaten (SD)	1221.25 (761.10)	996.17 (168.58)	-162.17 (774.85)	1021.67 (526.43)	1360.86 (391.29)	170.42 (602.99)	0.50
Calorie goal vs average calories eaten (SD)	1591.00 (161.79)	996.17 (168.58)	-593.50 (53.49)	1581.75 (126.00)	1360.86 (391.29)	-220.89 (380.19)	0.14
Average days per week compliant with food log (SD)		2.53 (2.45)			5.67 (1.36)		

*Significance

Table 2. Outcome measures pre and post study

	Control			Intervention			
	Pretest	**Posttest**	**Change**	**Pretest**	**Posttest**	**Change**	***P* value**
Pulse (bpm) (SD)	75.2 (8.67)	74.4 (4.77)	-0.80 (9.44)	78.13 (12.17)	77.88 (8.89)	-0.25 (12.13)	0.94
Systolic blood pressure (mmhg) (SD)	122 (24.82)	116.4 (9.21)	-5.6 (17.11)	113.25 (8.21)	115.00 (7.78)	1.75 (11.63)	0.37
Diastolic blood pressure (mmhg) (SD)	74.40 (17.05)	73.60 (12.44)	-0.80 (5.93)	71.25 (4.89)	70.00 (5.24)	-1.25 (6.41)	0.90
Weight (lbs) (SD)	173.76 (39.82)	168.98 (40.98)	-4.78 (6.52)	171.68 (20.72)	170.50 (19.83)	-1.18 (6.30)	0.40
BMI (SD)	30.58 (5.76)	29.82 (5.85)	-0.76 (1.12)	30.40 (4.19)	30.00 (3.24)	-0.40 (1.14)	0.67
Lean body mass (lbs) (SD)	92.94 (17.56)	92.22 (19.26)	-0.72 (3.63)	91.83 (13.39)	93.01 (14.80)	1.19 (3.31)	0.35
Fat mass (lbs) (SD)	74.49 (23.03)	71.06 (23.19)	-3.43 (2.99)	71.91 (12.88)	71.69 (13.55)	-0.23 (2.05)	0.07
Body fat % (SD)	43.94 (4.11)	42.68 (4.13)	-1.26 (0.48)	43.89 (5.54)	43.66 (5.75)	-0.23 (1.11)	0.07
Visceral fat mass (lbs) (SD)	1.29 (0.72)	1.23 (0.68)	-0.06 (0.22)	1.23 (0.78)	1.22 (0.75)	-0.01 (0.18)	0.68
Calculated RMR (SD)	1291.00 (161.79)	1284.20 (176.95)	-6.80 (32.66)	1281.75 (126.00)	1292.25 (138.15)	10.50 (29.49)	0.34
BSQ-16A Survey (SD)	62.40 (12.26)	43.80 (12.91)	-18.60 (8.41)	48.00 (12.29)	41.86 (9.30)	-6.14 (6.07)	0.19

*Significance

Fat % was bordering on significant. Therefore, the study should be conducted on a larger cohort of subjects. The study acknowledged that after the first month, MyFitnessPal™ use dropped considerably. Additionally, the study did not include counselling from healthcare professionals or reinforcement from a health care team to help ensure compliance with the program [7]. Another study at the University of Arizona showed that use of MyFitnessPal™ influenced patients to be more compliant in recording their food intake than patients who used the traditional paper-and-pencil method of recording [5].

Requiring subjects to report their calorie intake each week, demonstrated better compliance with their individual calorie recommendations: The intervention group recorded an average of three days more per week than the control group. However, this had minimal impact on body composition. The greater loss of body fat seen in the control group may be attributed to the pressure placed on the intervention subjects. The subjects were informed that they would be required to return after eight weeks of dieting. The intervention group had their diet monitored weekly. The knowledge of having their eight-week diet evaluated may be why the control group lost more weight than compared to the intervention group.

Interestingly, a high BSQ-16a indicates a high susceptibility for an eating disorder. Both groups began with similar elevated scores and both groups improved their scores. It is unknown which had a greater effect on the BSQ-16a scores, the subjects weight loss or the use of the calorie counting application. It is hypothesized that the decrease in BSQ-16a scores may be due to the subjects increased attentiveness of their food intake. Further studies should consider evaluating BSQ-16a scores in subjects who are not trying to lose weight.

These results may indicate that frequency of use of the smartphone application had no effect on body composition. But use of the application with minimal compliance may still have a positive impact on weight loss.

While this pilot study showed promising results, there are limitations that must be mentioned: 1) The subject pool was relatively small and limited to college aged females. which may not be an accurate representation of the general population. Further studies should attempt to examine a larger population with a more diverse pool of subjects. 2) The study design included rolling admission, which may have been a limitation. For example, those subjects who participated in the study over a holiday period were less compliant, which they reported as being due to the holiday. Future studies should require all subjects to participate during the same time period for a longer duration. 3) Historically, nutritional studies such as this one includes inaccurate reporting due to recall bias and self-report bias.

The MyFitnessPal™ application shows promise in its clinical use for weight loss and other body composition metrics. The application also

has potential as a treatment tool for typical eating disorders. Further studies are encouraged.

Acknowledgment

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