

Major Article

Mobile MyPlate: A Pilot Study Using Text Messaging to Provide Nutrition Education and Promote Better Dietary Choices in College Students

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Abstract. Objective: To evaluate the acceptance and effectiveness of repetitive nutrition-related text messages on college students' nutrition knowledge and fruit and vegetable consumption. **Participants:** One hundred fifty undergraduate (18–24 years old) non-health major students with a texting mobile phone. **Methods:** The intervention group received biweekly text messages of the MyPlate icon and the United States Department of Agriculture's Dietary Guidelines (DGs) for 7 weeks. The control group received the same information in a mailed brochure. A pre and post online survey assessed the students' knowledge and behavior. **Results:** The intervention resulted in greater MyPlate food group recognition ($p < .05$) compared with control and a trend toward improved knowledge of the DGs. In the intervention group, fruit consumption was elevated ($p < .05$) and a trend toward elevated vegetable consumption was determined. No gender differences in intervention effectiveness exist. **Conclusion:** Texting repeated messages appears to be an acceptable and effective way to increase nutrition knowledge and promote positive diet-related behaviors in college students.

Keywords: adolescents, college, health education, MyPlate, nutrition

The United States Department of Agriculture's (USDA's) dietary recommendations have been displayed to the nation in various ways since 1890 when

the concept of an adequate diet was based simply upon protein, energy, and a few minerals.¹ Americans were first exposed to the Daily Food Guide (Basic Four) in 1958 as the US government sought to publicly raise awareness about nutritional deficiencies,² but only half of Americans are aware of guidance recommendations.³ The current college-aged population was most likely first exposed to dietary recommendations in elementary school via the Food Pyramid (1992). The Food Pyramid's representation of balanced eating demonstrated a misleading hierarchical display of numerical servings rather than the health benefits of the food group.⁴ By the time this generation entered high school, the USDA revised the Food Pyramid into MyPyramid (2005). MyPyramid rotated the 1992 Food Pyramid, emphasizing the importance of each food group while incorporating physical activity.⁵ In 2011, MyPlate was introduced, which is a visual representation of mealtime recommendations and the proper food group distribution.⁶ Around this same time, almost all of Americans 18–29 years old were sending and/receiving text messages ("texting") daily,⁷ and more than half of this population were on their way to college.⁸

The transition to college, which usually occurs between ages 18 and 24, has been identified as a critical time for significant and rapid weight gain due to poor dietary choices.^{9,10} Although the average weight gain for American adults is about 2 pounds per year,¹¹ those attending college can expect to gain 4–9 pounds in the first 2 years of college.^{9,12} These years may have an important role in establishing patterns of physical activity and health beneficial behavior to continue into adulthood.¹³ Overweight college students are more likely to become overweight adults¹⁴ and are at a higher risk for diet-related chronic diseases such as cardiovascular disease,

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type 2 diabetes, some cancers, and hypertension.¹⁵ Texting can be an effective delivery method for student health behavior interventions because the messages can be delivered at any time without disrupting the recipients' current activity.¹⁶ College students appreciate the unobtrusive convenience and low cost of texting and use it often in daily life for multiple reasons.¹⁷ Using texting as an attempt to change health behaviors allows for repetition without annoyance; moderate repetition leads to greater understanding of the context that is being conveyed.¹⁸ Thus, texting offers a valuable mode of communication for college students as well as a possible pathway for future health education and behavioral interventions.

Researchers have employed the use of academic courses, printed social marketing, point of sale, and Internet interventions to help facilitate positive health behaviors in college students.^{19,20} Ironically, the one form of communication that has not been used very widely to increase positive health behaviors in college students is texting. Texting has been shown to be effective in other health interventions. An innovative online and cell phone intervention for college students was conducted at several colleges across the nation in an attempt to increase smoking cessation.¹⁶ As a result, 34% of participants quit smoking after 6 weeks. Additionally, participants indicated that the text message component of the intervention was easier to use than the Web-based section. The messages were sent during their routine high-risk situations and the participants were also encouraged to send "SOS texts" when they were craving a cigarette. Another intervention conducted at Emory University attempted to reduce the negative effects of alcohol consumption for college students.²¹ The participants were given handheld computers with which they completed daily surveys about their drinking behaviors and also received messages about the consequences of their behaviors. Weitzel et al²¹ reported that this form of message delivery had a small but positive effect on the students' attitudes and drinking behaviors. More recently, "plan reminder" and "goal reminder" text messages were implemented to increase the amount of brisk walking in college students. Regardless of the type of text message reminder, the amount of brisk walking did increase in the students involved.²²

The purpose of this pilot study was to increase awareness of the MyPlate icon and to evaluate the effectiveness and the appropriateness of using mobile phone texting to deliver the MyPlate icon and behavior-directed motivational Dietary Guideline messages to college students.

METHODS


The project was approved by the Institutional Review Board (IRB) at Purdue University (IRB protocol 1109011189). Consent was received by all participants after the online screener was satisfied; the consent document was part of the online survey in which the participants had to either accept to enroll or decline to exit the survey. A mass recruitment e-mail with a link to the survey was sent from the Registrar's Office to ~4000 randomly selected stu-

dents who met the following criteria: 18–24 years old, a full-time undergraduate student, non-nutrition, exercise science, and/or kinesiology major, and not currently enrolled in a nutrition course. Students who indicated they did not have regular access to a mobile phone with MMS (multimedia messaging service) capabilities were excluded. When 60% of either male or female participation was achieved, participation was closed to that gender. Participants were randomly assigned to the treatment or control groups by gender and in the order that they completed the online survey. The baseline and postintervention survey for both groups included a screener, consent form, demographic data collection tool, self-reported food frequency questionnaire (Rapid Eating and Activity Assessment for Participants Short Version²³), and a MyPlate recognition assessment. The intervention group also evaluated the intervention at post intervention. The survey was powered by Qualtrics Survey Software (version 2011; Qualtrics, Provo, Utah). The respondents were required to enter their full name, address, phone number, e-mail, along with other personal information. To ensure the integrity of data collected, the students were required to present their student ID with their name and picture on it to receive their compensation; this helped ensure that the data collected were specifically derived from the intended reporters.

Each Mobile MyPlate text message consisted of the MyPlate icon along with 1 of the 7 behavior-directed motivational Dietary Guideline messages. The messages were developed by the Dietary Guidelines Alliance—a public-private partnership among leading food, nutrition, and health societies and industry organizations, in liaison with the United States Department of Agriculture and Department of Health and Human Services.²⁴ The messages were made into 7 different compatible multimedia messages, which are represented in Table 1. The intervention group received 2 repetitive text messages a week for 7 consecutive weeks that contain the Mobile MyPlate messages. Intervention participants received a study survey confirmation text message as a test. Participants were instructed to text "STOP" to quit when they no longer wanted to receive Mobile MyPlate text messages at any point in the study. The control group received a brochure at the beginning of the intervention containing the MyPlate icon along with the same 7 behavior-directed motivational Dietary Guideline messages. Participants were compensated \$5 for completing the pre survey, and \$10 for completing the post survey.

The data were analyzed using SPSS statistical software program (version 20; IBM SPSS, Armonk, New York). An analysis of covariance was used to determine impact, with the group being the major factor (control vs intervention). To determine statistical significance between pre and post data of the learning and behavioral assessments, each participant response was scored based on the number of questions in that specific portion of the survey. The pre score was subtracted from the post score to determine the change. The higher the percent change between the scores indicated greater improvement. The percent change scores were compared within group as well as between groups

TABLE 1. Mobile MyPlate Biweekly Text Messages

Week	Text message
1	 <p>Balance your calories. Go to the website and find out how many calories YOU need. Balance your food intake and your energy output to help you manage a healthy weight.</p>
2	 <p>Enjoy your food but avoid oversized proportions. Pay attention to hunger and fullness cues to recognize when you've had enough. Use smaller plates and bowls and portion your food according to serving sizes.</p>
3	 <p>Make half your plate fruits and vegetables. Vary the color of your vegetables; each color contains different nutrients. Add fruit as a side dish or a substitute for dessert.</p>
4	 <p>Switch to fat-free or low-fat dairy products. They have the same amount of calcium but fewer calories and less saturated fat.</p>
5	 <p>Make half your grains whole. Substitute whole grains for refined products such as whole wheat bread or brown rice.</p>
6	 <p>Compare sodium in foods. Check the nutrition facts label and choose the item with less sodium.</p>
7	 <p>Drink water instead of sugary drinks. Cut calories by drinking water or unsweetened beverages. Soda, energy drinks, and sport drinks are a major source of added sugar and extra calories.</p>

using the appropriate *t* test and/or the Mann-Whitney *U* test for ordinal data. If there was any missing data from a participant, that participant was not included in the final analysis.

RESULTS

Participants

Two hundred sixty-two individuals started the survey, 171 individuals completed the screener, 165 individuals consented to participate, 155 completed the survey, and 150 provided contact information to receive compensation. One brochure was returned in the mail. Three participants in the intervention replied “STOP” one participant replied ‘STOP’ after the first text (week 1), another participant replied “STOP” after the second text (week 1), and the last participant replied “STOP” after the sixth text (week 3). One hundred sixteen participants completed the post survey, of which 62 were intervention participants (77% retention).

The majority of the participants were white (90%), 22 years of age (57%), in their senior year/fourth year of undergraduate education (79%), living off campus in a house or apartment (66%). Although the intention of the study was to recruit 18–24-year-old college students, there were no 18- or 19-year-old participants or first-year (freshmen) participants.

MyPlate Food Group Recognition

At baseline, about 20% of all of the respondents reported that they had heard of/seen MyPlate. About 12% of the intervention group and 10% of the control group reported that they visited ChooseMyPlate.gov at baseline. At the end of the intervention, 72% of the intervention group and 42% of the control group reported visiting ChooseMyPlate.gov. There was no difference at baseline in food group recognition of the MyPlate icon between the control and intervention groups (Table 2). At the end of the intervention, the intervention group showed a statistically significant greater change in recognition of the MyPlate food groups ($p < .05$). None of the control group participants received a perfect score for recognizing the MyPlate food groups compared with 33% of the intervention participants. Seventy-two percent of the control group participants either decreased or didn’t change their knowledge of the MyPlate food groups compared with 33% of the intervention group. The baseline and post scores of the intervention group were 20.7% and 52.8%, respectively, and the percent overall change in knowledge of the MyPlate food groups was statistically (32%, $p < .05$) different from the control group. The vegetable group was the most easily recognized food group for all study participants, at baseline and postintervention. The protein group was the least recognizable at baseline for both groups and remained the least recognizable at postintervention for the intervention group; the grain group was the least recognizable in the control at postintervention.

TABLE 2. MyPlate Food Group Recognition

MyPlate food group	Baseline		Post INT		Change	
	INT	CNT	INT	CNT	INT	CNT
Fruit	6	5	27	18	13	21
Grain	9	8	29	6	-2	20*
Vegetable	28	30	44	38	8	16
Protein	1	2	23	15	13	22
Dairy	19	19	37	26	7	18
Mean total score	1	1.2	4.9	1.9	3.9	0.7
Mean total %	20.7	24.2	52.8	38.1	13.9	32.1*

Note. INT = intervention; CNT = control; Results are represented based on the number of correct responses given by the participants. The mean total score represents how many answers they got correct out of the 5 total questions/food groups. The mean total percentage shows their scores based out of 100%.

*Significant difference in the change of knowledge between the control and intervention group, $p < .05$.

Eating Behaviors

Table 3 is a description of the reported eating habits of the participants who completed the survey. Forty-three percent of the respondents indicated that they skipped breakfast “usually/often,” and about one-third reported that they “rarely/never” skipped breakfast; 47% of the respondents reported that they “rarely/never” ate 4 or more meals from a sit-down or take-out restaurant, and 34% reported “rarely/never” eating less than 3 servings of whole grain products. The intervention group had a statistically significant increase in fruit consumption compared with the control group ($p < .05$). Seventeen percent of the control group participants experienced a negative change in behavior in fruit consumption compared with 6.6% of the intervention group. The intervention group also showed a trend towards an increase in vegetable consumption.

Evaluation

Intervention Group

All of the intervention participants who completed the post survey ($n = 62$) reported that the monetary incentive played a role in their motivation to participate in the study. The majority (84%, $n = 52$) of the participants reported that receiving the regular text messages helped them stay focused on their health. Additionally, 98% ($n = 61$) of the participants reported that text messages were a good way to receive health information. Almost half (48%, $n = 30$) agreed that text messages were the best way to communicate health information to college students; texting was followed by Facebook (23%, $n = 14$) and a classroom setting (18%, $n = 11$). Participants reported that the consistent and persistent text messages helped them stay motivated throughout the intervention. Only 5% ($n = 3$) of participants said that they did not learn anything new from the intervention and

TABLE 3. Baseline Eating Habits (n = 150)

	Usually/Often (%)	Sometimes (%)	Rarely/Never (%)	Does not apply (%)
Skip breakfast	43	23	34	1
> 4 meals from restaurant	19	33	47	1
Eat < 3 servings of whole grain products	27	39	34	0
< 2–3 servings of fruit a day	39	49	12	0
< 3 servings of vegetables/potatoes	35	37	28	0
< 2–3 servings of milk, yogurt, or cheese	21	23	56	1
Use 2% or whole instead of skim milk	30	9	43	19
Use regular cheese	57	21	18	3

97% ($n = 60$) reported that they will use the information they learned again in their future health decisions.

At the end of the intervention, participants were also asked to give suggestions on communicating health information to college students. Only 1 person said that text messaging was not an effective route. Eight percent suggested more detailed text messages that were tailored to their lifestyle choices such as menus at campus restaurants and dining courts. Five percent of participants suggested that an e-mail component would have been good if/when text messages were overlooked or ignored or could not provide enough information on the topic. Eleven percent said that a social media aspect would have been beneficial to gain more knowledge about a certain topic. When asked about a better way to reach out to college students, 13% suggested social media, 8% suggested e-mail, and 16% suggested more frequent and regular contacts in e-mail, text, or in person would further instill learning and behavior change.

Only 1 (2%) participant in the intervention thought that Mobile MyPlate was not successful (“Get rid of it”), 10 (16%) participants said to “Work on it,” 15 (24%) participants reported that it was “OK,” 29 (47%) participants thought it was “Good,” and 7 (11%) reported that it was “Great.” When asked to give suggestions on how to improve Mobile MyPlate, participants suggested a social media component such as Facebook or Twitter. As far as the text messages were concerned, 7% said that the text messages needed to be more detailed and tailored to their individual campus and lifestyle, 8% said not to repeat the messages because they wanted to see new information every time, and 8% suggested interactive learning where they could respond to the text with questions and receive answers instead of going onto the MyPlate Web site. Some other suggestions included making the text messages more appealing by using emoticons and including access to a calorie counter. Also, participants suggested making Mobile MyPlate into a phone application including all the resources suggested previously.

Control Group

The majority of the control participants who completed the post survey ($n = 54$) reported that the monetary incentive played a role in their motivation to participate in the study. When asked to give their thoughts about the best way to communicate health information to college students, 0% chose regular mail, 24% chose e-mail, 26% chose text message, 24% chose Facebook, and 26% chose classroom setting. Some of other suggestions on how to communicate health information to college students from the control participants included “social media,” “text message,” “flyers,” and “info on-campus.” Ironically, one student wrote, “Mail is awful. E-mail, text, Facebook, or anything online allows students to simply ignore it [mail].” Some of the suggestions to better reach college students from the control group include “social media,” “more information,” and “direct information via e-mail, personal contact.”

COMMENT

This study supports other evidence of the effectiveness of a text message–based health education intervention; however, this is the first intervention combining nutrition education and texting for college students. Text messaging in the health care field has been shown to be used in 4 ways: remote controlling and monitoring, information services, adherence, and management.²⁵ Remote control and monitoring is used for support such as home management for weight loss or medical treatment and management is used in ways such as reminding patients of appointments. Information services use the messages to distribute educational material relative to the receiver. Adherence utilizes the messages to support a lifestyle change such as self-management of a healthy behavior. Mobile MyPlate was implemented using 3 of the frequently used methods: information service, adherence, and management. The duration of Mobile MyPlate was consistent with other studies that utilized informative and adherence text message

interventions, except 1 weight management study for 13–16-year-olds that lasted 2–12 months that also included an e-mail component.²⁶

In a focus group to assess a text message smoking cessation intervention, the participants explained that texts received during high-risk situations would be the most useful towards behavior change.²⁷ Thus, the Mobile MyPlate messages were sent before the lunch hour (~11:30 AM) so students would have read it and have thought about it during the risk period of choosing lunch options. The timing of the messages was more convenient than the mailed brochure that the students most likely read once at the beginning and possibly again before the posttest. Additionally, the participants received the same message twice a week in order to further instill understanding of the content; consistent and persistent exposure has been linked to knowledge and behavior change.¹⁸ In a study that showed an increase adherence to malaria treatment guidelines by health care workers in Kenya, the same 10 text messages were sent out Monday through Friday for 6 months. The repetitive messages emphasized the importance of the treatments and also aided in the health workers' forgetfulness.²⁸

Text messaging via mobile phone is an effective route of information processing. In a text message–based intervention for weight loss in adults (25–55 years old), the intervention group received 2–5 text messages per day to aid them in weight loss.²⁹ The intervention group lost more weight than the control group, who received only a paper pamphlet of weight loss material once a month. The intervention participants also had extremely high satisfaction levels with this type of weight loss intervention. At the completion of the study, 1 participant stated, “I miss my 6am message!” Responses from intervention participants in Mobile MyPlate support the acceptability of receiving texts for health messages.

In a review article of health-related behavior interventions utilizing text messaging, 10 of the 16 studies showed significant improvements in the health-related intervention, whereas the remaining showed positive trends supporting the text message intervention strength.³⁰ Similar results of knowledge change have been shown with other health-related text message interventions. In a population of 13–25-year-old women, text message reminders were sent pertaining to oral contraception continuation and education compared with the control group, which continued their routine clinical care.³¹ Consistent with Mobile MyPlate, the 2 groups started with similar scores at baseline, and the text message intervention showed a greater increase in knowledge compared with the control group. Additionally, an Australian study by Gold et al targeting 16–29-year-olds sent out bimonthly text messages during the summer about education of either sexual or sun-related behavior. Again, like Mobile MyPlate's increase in positive eating behaviors, Gold et al reported an increasing trend in practicing positive health behaviors.³²

Most health care services in the United States, especially preventative services, are an expense that is not accessible to all populations.³³ Therefore, people are less apt to see and

pay a clinical dietitian to obtain direct and accurate dietary information tailored to their age group. However, a large portion of this country has a cell phone with some type of text messaging capabilities. In fact, wireless subscriptions are surpassing the population of the United States. In the latter half of 2011, there were 321.7 million wireless subscribers and only about 311 million people in the states combined with Puerto Rico, Guam, and the US Virgin Islands.³⁴ Of that 321.7 million, only 15.2 million of those devices were not cell phones, such as tablets and laptops, which make up less than 1% of all wireless devices used in the United States. Young children, the elderly, and low-income groups may not have access to a cell phone; regardless, statistics show that cell phone usage in the United States is more than popular, it's common. In 2011, 1.138 trillion text messages were sent; when divided by the total 311 million people in the country, that is over 3,600 text messages per person per year.

Text messaging is an inexpensive mode of communication that can be easily repeated; repetition leads to a greater change in knowledge and behavior.¹⁸ A text message allows the ability to send words, instructional pictures, as well as links to other sources. A link could lead to a Facebook page, a Twitter account, or a blog where the participants or patients can comfortably and anonymously ask questions, post their concerns, and discuss issues among people with similar issues. Therefore, a text message intervention can reach out to a variety of populations due to the fact that the average person is already subscribed to a wireless network and a text message is not invasive or annoying.

Mobile MyPlate covered a broad variety of nutrition education and still showed reported behavior changes. Some of the limitations of this study are that the behaviors were self-reported, which leads to a potential for reporting bias. Due to the fact that this was a pilot study, there was no cross-validation used to validate the responses of food consumption such as a 3-day food record or other face-to-face counseling techniques. However, one of the main purposes of a text message intervention for education is the simplicity and convenience of the messages. They can be sent and/or read at the recipients' convenience and does not require them to be present at a face-to-face meeting. In today's busy society, it is often difficult for people to add extra commitments into their schedule.

We did not have the ability to document if and when the text messages were actually read by the receiver. After talking to wireless providers as well as text message marketing and mass text message companies, it is not possible for the sender to indicate if the receiver has opened or read the text message unless it was via iMessage. In order to determine if the message was read, it would require a response message sent from the recipient back to the sender either to confirm that the text message was read or to respond to a simple question pertaining to the educational information in the text message. Although this is a limiting factor to the study design, it poses the same limits as other methods of education, as we can't ensure the “student” is listening.

Since there has not been a long-term follow-up for Mobile MyPlate, there is no way to tell if the results had a lasting effect or if the behavior changes only occurred during the intervention period. Furthermore, if the intervention had been more specific or focused on 1 topic, such as increasing calcium intake, the behavior may have changed even more, resulting in more permanent or longer results. With a more specific topic, more detailed messages could be generated. Instead of just suggesting eating low-fat dairy products like Mobile MyPlate did, the text messages could explain how to recognize high-fat products or a more in-depth educational module to explain each health message in greater detail and provide applicable nutrition advice.

Lastly, the sample does not include any freshmen, which is a disadvantage to the study results, as freshmen experience the greatest level of transition. Apparently, freshmen were not included in the recruitment e-mail that was sent from the Registrar's Office.

Conclusion

The focus of this study was to determine whether a text message intervention was an adequate and acceptable form of nutrition education for college students, and to increase awareness of the MyPlate icon. Based on the changes in knowledge and behavior as well as the additional comments that the participants provided, Mobile MyPlate was shown to be an acceptable and effective intervention for this audience. The data collected from this pilot study support the effectiveness of a repetitive text message intervention to increase nutrition awareness and improve eating behaviors of both male and female college students. Future use of interactive text messages to promote specific nutrition-related knowledge and eating behaviors is recommended, as well as long-term follow-ups to determine long-term behavior change.

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CONFLICT OF INTEREST DISCLOSURE

The authors have no conflicts of interest to report. The authors confirm that the research presented in this article met the ethical guidelines, including adherence to the legal requirements, of the United States and received approval from the Institutional Review Board of Purdue University.

NOTE

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