Evaluation of a mobile phone-based intervention with photographs to improve healthy food choices

Introduction

Unhealthy food choices are an important component of our daily lives that increase the risk of several diseases such as obesity, diabetes or other metabolic disorders. Encouraging correct eating habits is vital for the purpose of preventing such conditions. [1,2]

Obesity is a major public health problem, and to combatting this situation requires cost-effective and scalable weight management programs. [3]

Mobile phone-based interventions have demonstrated positive effects on body composition [4,5] and food habits [6,7]. They are cheap, easy to implement and could play an important role in fighting health problems.

The use of mobile phones and SMS has spread through all age groups with different cultural and socio-economic backgrounds. Nowadays mobile phones and text messaging have been integrated into all the aspects of communities in both developed and developing countries. [8]

Participants who use traditional paper methods of self-monitoring often find the use of a calorie book and calculation of all foods eaten to be tedious and time-consuming [9]. Self-monitoring is a method of systematic self-observation, periodic measurement and recording of target behaviors with the goal of increasing self-awareness. [10] For this reason, individualization of self-monitoring by mobile phones is a possible strategy to improve adherence [11,12]

These new technologies have great potential for promoting public health by delivering interventions and interactive communication and assisting people in disease self-management and prevention [13,14]. Cell phones offer participants a modern and personalized way to monitor their own behaviour, something that makes this methodology more appealing when compared to more traditional self-monitoring methods, and allow data to be easily recorded, even offering combination with other devices [15,16]. Using mobile devices for self-monitoring is a promising way to make the process easier and can provide real-time data [17,18] awaking high interest in general population [19].

Some reviews [14,20–22] have studied changes in knowledge, attitudes, general healthy behaviours and even weight loss. However, their potential as tools for monitoring or dietary treatment has yet to be examined. As far as we know, no specific application has been designed to keep health specialists and patients in touch, providing fluid communication between them to record, monitor and evaluate dietary behaviour via photographs.

Our aim was to evaluate the acceptance and impact of a mobile phone-based intervention using a mobile instant messaging application, delivering photos and counselling between patient and dietitians.

To describe the experiences of users of a mobile-phone app designed to provide monitoring and deliver feedback with healthy choices.

To identify factors facilitating usage of a phone-based intervention with photographs.

METHODS

We carried out an experiment via an instant message application over 5 working day.
Population
20 young adult Spanish volunteers were enrolled to upload and send all their food choices to a dietitian via a mobile instant messaging application. They were asked to send information on all intakes other than water to their dietitian during the trial.

The dietitian responded with a numerical evaluation of how healthy the volunteers’ choice was on a scale of 0 to 5, including an attached photo as a healthier alternative. The dietitian's evaluation was a subjective score considering food choices and food techniques, where 0 = “Not healthy at all” and 5 = “Totally healthy”. The alternative intake suggested was the food choice of another participant with the same score or better.

No other form of communication was allowed between patient and specialist. One week after the intervention the participants completed an online survey to measure their responses and feelings during the trial.

Results
A total of 10 male and 10 female adults between 20 and 30 years of age took part in the experiment (average age 25.4±2.4).

A total of 368 intakes were evaluated and 368 different intakes were suggested as alternatives. The average number of photographs uploaded per day to each participant are shown in Table:

Table 1: Shows the average number of intakes and the daily score.

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean intakes (Number of intakes per day and person)</td>
<td>3,8±0,8</td>
<td>3,7±0,5</td>
<td>3,6±0,6</td>
<td>3,6±0,6</td>
</tr>
<tr>
<td>Mean score (Score obtained by dietitian)</td>
<td>3,5±0,5</td>
<td>3,4±0,6</td>
<td>3,4±0,5</td>
<td>3,4±0,4</td>
</tr>
</tbody>
</table>

There were no significant differences over the 5 days of the study. After multivariate analysis, we found that scores are not explained by any particular variable (gender, number of intakes or age).

Evaluation
We provided participants with an online survey using a Likert scale in order to collect information on their experience during the trial. 17 replies were obtained from the total of 20 participants. Table 2.

Table 2: User experience and feelings during the intervention

<table>
<thead>
<tr>
<th>Question</th>
<th>Online survey answers (Likert scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly agree</td>
</tr>
</tbody>
</table>


1. During the experiment I changed my eating habits  

| Percentage | 5,9% | 41,2% | 23,5% | 29,4% | 0,0% |

2. The experiment influenced me indirectly to eat more healthy food  

| Percentage | 17,6% | 64,7% | 5,9% | 11,8% | 0,0% |

3. The experiment motivated me indirectly to eat more healthy food  

| Percentage | 17,6% | 76,5% | 5,9% | 0,0% | 0,0% |

4. My eating was healthier during the experiment than the following week  

| Percentage | 11,8% | 47,1% | 35,3% | 5,9% | 0,0% |

5. I consider my adherence during the trial as “correct”  

| Percentage | 41,2% | 47,1% | 11,8% | 0,0% | 0,0% |

6. Reminder messages would have helped me check the app more often  

| Percentage | 23,5% | 47,1% | 17,6% | 11,8% | 0,0% |

7. It was a lot of trouble to send the photos daily  

| Percentage | 0,0% | 0,0% | 0,0% | 47,1% | 52,9% |

8. I consider my score was reasonable, based on my knowledge of dietetics  

| Percentage | 11,8% | 58,8% | 17,6% | 11,8% | 0,0% |

9. I was able to predict the score of my food choices  

| Percentage | 11,8% | 76,5% | 5,9% | 5,9% | 0,0% |

10. I felt motivated to keep on sending photos  

| Percentage | 23,5% | 64,7% | 11,8% | 0,0% | 0,0% |

11. I was curious to know more about the authors of the other photos I received  

| Percentage | 17,6% | 41,2% | 35,3% | 5,9% | 0,0% |

12. I was curious to know who evaluates my photos and how.  

| Percentage | 29,4% | 47,1% | 17,6% | 5,9% | 0,0% |

13. After the experiment I feel able to identify the criteria when evaluating food choices.  

| Percentage | 11,8% | 70,6% | 5,9% | 5,9% | 5,9% |

14. I think the alternative photos I received were as healthy or healthier than my choices.  

| Percentage | 17,6% | 58,8% | 11,8% | 5,9% | 5,9% |

15. The alternatives I received were suitable to my context  

| Percentage | 29,4% | 41,2% | 17,6% | 11,8% | 0,0% |

16. It was useful to receive alternatives made by other people.  

| Percentage | 41,2% | 58,8% | 5,9% | 0,0% | 0,0% |

Other open or semi-open questions included in the survey were the following:

**Question 18. Describe what you enjoyed about the experience. Some testimonials were:**

-It creates a link with someone who supports and orientates you.
-Monitoring was very quick, which allowed you to think between meals about what you could change.
-To know whether what I really eat is healthy and to what extent, thanks to the scores.
-I enjoyed getting other food options to widen my choices.
-It makes you be more careful about your eating habits and think more about your food.
-I like the fact that you think more about what you eat and how you present it at meal times.
-In general, to be aware of alternative and variations when thinking about a meal.
-Because I had to take a photo before eating the food, I prepared it completely and kept the amounts under control.
-Suggestions for meals, particularly breakfast.
-Discovering different menus.
-Motivation to eat better.
-It was fun to find out your score.
-I enjoyed it very much because you want to compete and it motivates you to improve your next meal and get the highest score.
-It gave me ideas to draw up my weekly menu and complement some other meals.
-There were positive effects from the attention I paid to meals, being aware of the preparation of my food and the ingredients and feeling that I was going to be evaluated.
-It helped me follow my diet better than any other week.
-I controlled myself much more because I had to put all the food together for the photo and so I avoided my usual nibbling after a meal. Also, once you get into the habit, it is easier and more practical to be able to enjoy healthy food.
-To be more aware of everything you eat throughout the day.

The most noteworthy questions mentioned by the participants are the motivational aspect of the experience, or the usefulness of alternative suggestions for meals. Other advantages for the participants were the awareness of what they eat and being able to control their food better.

Question 19. Describe what you did not like about the experience. Open answers given:

-It’s over.
-The numbered score is not enough, it can even make you feel helpless, or if you don’t understand the reason for a mark you might think you’re eating well and a score doesn’t give you the information to understand why or why not.
-Not having an explanation for some scores, because sometimes I thought the meal was balanced, but the score didn’t show that.
-I would have liked a more detailed monitoring of my daily eating habits.
Some people might have thought their food was worth 5 stars, but they only got 4, or the other way round. I suppose that the app could explain why you get that score and then suggest an alternative to improve that meal and reach the highest score.

I didn’t like the fact that it didn’t adapt to each person’s characteristics (how much you weigh, how much you need, what your daily routine is), so I think it was a very basic experiment.

Not knowing the reasons for the scores of your meals.

Obviously, I would have liked a record of results.

It should take into account the allergies, intolerances, or dislikes of each person.

Lack of information on my eating habits, physical characteristics and living habits for correct scoring and suggestions of options.

I did not think some of the alternatives or options were entirely correct, because in my case, since I play sports, I have higher energy requirements than a sedentary person for whom the meals suggested could be suitable. Also, in my case, it should consider the time of day when I train, when I eat and with what purpose.

The result was not immediately available after sending the photo.

Not knowing exactly where I was going wrong.

The outstanding areas for improvement are lack of personalization and lack of information on the dietitian’s evaluation criteria.

Discussion

Principal results

The participants stated that the experiment made them change their routines, eat a more healthy diet and feel motivated. Unfortunately, we did not collect pre-intervention or long-term dietary records.

82.4% of the sample state they were influenced to eat more healthy food. 95% were “motivated to eat better during the experiment”. Furthermore, 58.8% acknowledged their diet was better during the trial than their normal routine.

Limitations

We believe scoring was moderate because the study took place over a relatively short period. If it had lasted longer, we may have obtained better scores, as occurred in the cases of [6,23], which recorded similar changes in more complex variables such as body mass, intake and biochemical indicators.

We are aware that the length of the study and the number of participants do not allow for further extrapolation of the results. However, these are of interest as indicators of the main questions involved in the development of mobile applications in this field and how they may be improved.

The methodology of the study did not allow for personalised alternatives, which may have been desirable for people with special needs. One of the most requested improvements was an explanation of the scores.

Nonetheless, the main contributions of our experiment have to do with the behavioural aspect and how to improve the user experience. We believe that reminders, an intake collection and a system which allows more personalised suggestions would be vital to further improve people’s experience and motivation.
Comparison with prior work
We have seen in other studies that motivation with this type of tools increases and therefore monitoring is better [24,25] which may be one of the reasons for motivation being maintained in the long term and a community being formed.

Replies to the open survey along the lines of “I can take control or be more aware” coincide with the studies [4,9], where mobile phone monitoring helped in controlling food ingest and reducing calorie intake.

No one thought sending photos was troublesome, which supports the idea of other authors that this is a more attractive method of supplying information. [9]

Apart from the improvements in food choices, most of the participants (82.4%) said they had enough criteria to be able to identify healthy choices after the study. We can therefore infer that, apart from motivating and indirectly changing behaviour, the experience enhances understanding and does so in an entertaining manner. This is a empowering advantage compared with others studies focused on nutrients [7] or kcalories [6,17]

Some of the participants thought that a record should be kept or that more personalisation was required.

In our view, although the participants were able to deduce the criteria, it would have been preferable for them to know what to do to improve their scores.

Importance of reminders was highlighted, 70.6% suggested that receiving notifications would have been improved even more the adherence at sending photos [23]. Same conclusions were obtained in others studies, where SMS [26] and reminders were crucial to the success of the interventions. [7,27] or other favored further integration of medical apps in their daily routine. [28]

Conclusions
Designing and delivering a personalised diet through a mobile device is a challenge, but mobile phones may help in learning how to manage other behaviours such as healthier food choices, self-monitoring of the diet, or self-control.

An application using food choice photographs could be a valuable tool to motivate people to enhance their food habits with the direct assistance of dietitian.

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Conflicts of Interest
The autor Aitor Sánchez is owner and co-founder of a nutrition App: Bite.

References


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