

Dietary interventions using Facebook: a systematic review

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Abstract

Introduction: Facebook has been used to change food behaviors. The aim of this review was to synthesize the knowledge about the effect of nutritional interventions delivered through Facebook in dietary intake, food and nutritional knowledge and behavior, and weight management.

Methods: PubMed, Web of Science, Ovid, Scopus, and Cochrane electronic databases were searched for intervention studies that were published from 2013 to 2019. This systematic review protocol was formulated based on *Cochrane Guidelines for Systematic Reviews of Health Promotion and Public Health Interventions* and *Preferred Reporting Items for Systematic Reviews and Meta-Analysis* (PRISMA).

Results: Of the 4824 identified studies, 116 were considered for eligibility and 18 met the inclusion criteria of this review. Of these, 13 were randomized controlled trials, 2 were quasiexperimental studies, 2 were case studies, and 1 was a nonrandomized controlled trial. Interventions had a positive nutritional-related impact in most of the studies (78%).

Discussion: Positive changes in dietary intake, food and nutritional knowledge and behavior, and weight management were observed in studies that used Facebook as a component of intervention. Facebook effectiveness by its own was difficult to evaluate considering that is frequently a component of intervention. The heterogeneity of the outcome variables between studies did not allow concluding about the effectiveness of this tool.

Keywords: dietary intake, dietary interventions, Facebook, nutritional knowledge, weight management

Background

Unhealthy eating habits, according to the evidence, is one of the most important lifestyle risk factors for noncommunicable diseases, associated with metabolic and physiologic changes such as high blood pressure, high fasting blood glucose, high blood lipids, and overweight/obesity. Nutritional knowledge is an important predictor of behavior change to a healthier dietary intake, which is crucial to reduce the risk of diet-related diseases.¹ Nutrition experts face a big challenge empowering people with skills to improve their food and nutritional knowledge, dietary

intake, nutritional status, and well-being and to reduce the risk of diet-related diseases.²⁻⁴

Nutritional interventions are mostly designed for the participation of individuals through counseling, telephone contact, face-to-face meetings, and informative pamphlets.^{5,6} Web technology has been used in a diversity of interventions to health promotion, being considered as a potential tool for better engaging participants and communicating information that encourage positive health outcomes.⁷ Evidence suggests that the public currently prefer online formats instead of face-to-face, which may overcome barriers identified in face-to-face interventions, such as time limitation, physical distance of the participants, travel costs, and transport difficulties.⁸⁻¹²

Online social networks are currently the meeting point for most of the population, especially among the younger population. Facebook is a web-based social network that provides tools for establishing relationships between peers who share different information and activities but have common goals.¹⁰ The use of social networks for health communication also provides support between social and emotional peers,^{13,14} which seems to be an important determinant for behavior change.¹⁵⁻²⁰ Some of the major benefits of using this approach for health communication include the ability to share and adapt information to different target audiences, achieving geographical, age, and economic diversity.³ Online health interventions can influence voluntary behavior change, have lower costs, and provide communication lines with peers. Facebook groups, advertisements, pages, or games are some of the many ways to connect nutrition with the world.²¹

Public health organizations recognize the possibility of using social networks, such as Facebook, to reach their target population for disseminating credible health-related information.²² Health professionals, consumers, researchers, and

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policy makers have access to contradictory information about the effectiveness, acceptability, and ethical concerns of Facebook nutritional interventions, including health research evidence.²³

This systematic review analyzes the scientific evidence to evaluate whether Facebook could be an effective opportunity to deliver nutrition interventions to achieve a positive impact in nutrition-related outcomes. The review question addressed for this systematic review was, “Are Facebook nutrition-related interventions effective in nutrition-related outcomes (weight management, dietary intake, food and nutritional knowledge, food and nutritional behavior), feasible and acceptable for individuals?” To answer the purposed question, the aim of this systematic review was to synthesize the knowledge about the effect of nutritional interventions delivered through Facebook in nutrition-related outcomes (weight management, dietary intake, food and nutritional knowledge, food and nutritional behavior) to general population. As secondary objectives, it was intended to assess (1) the relation between offering compensatory/incentive gifts to the participants and retention rate of nutritional intervention using Facebook, (2) the engagement of the population into nutritional interventions using Facebook, and (3) the acceptability of nutritional interventions using Facebook.

Methods

Design

This systematic review protocol was formulated based on *Cochrane Guidelines for Systematic Reviews of Health Promotion and Public Health Interventions*²⁴ and *Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)*.²⁵ The characteristics and quality evaluation of each study are presented in summary tables. The studies were chronologically ordered by publication date.

Criteria for selecting studies

Types of studies. This review includes randomized and non-randomized controlled trials and experimental and quasiexperimental case study designs. Only published studies were included; protocols, qualitative studies, opinion articles, reports, guidelines, and review articles were excluded.

Types of participants. Participants eligible for this review were adults and children in case Facebook intervention was delivered through their parents, healthy or having a malnutrition condition, from both sexes.

Types of interventions. Interventions had to be delivered only through Facebook or multicomponent interventions that included Facebook as a delivery method. In addition, it had to compare 2 or more arms (intervention group and control group) or a pre-post evaluation (baseline data and postintervention data).

Types of outcome measures. Nutrition-related outcomes were included as follows: dietary intake, food and nutritional knowledge, food and nutritional behavior, and weight management. Engagement and retention were assessed to conclude about the feasibility of the interventions, and acceptability outcomes were also included.

Search methods for identification of studies

Literature search strategy. This review includes a systematic search conducted within *PubMed*, *Ovid*, *Web of Science*, *Scopus*, and *Cochrane* databases. The combination of terms conducted in the search expression was [Facebook AND Dietary intake OR Food and Nutritional knowledge OR Food and Nutritional behavior OR weight management OR anthropometry]. The search was conducted on June 5, 2019, using a time range between 2013 and 2019.

Data management and screening/study selection. The results from each database were imported into *EndNote* version X8 for an initial duplicate removal process. Then, 1 reviewer screened all the titles and abstracts. After removing records that did not fit within the inclusion criteria, articles with no accessible full text were excluded. The full text of the remaining articles was reviewed by 1 author to assess whether they accomplished the eligibility criteria. The reasons for excluding full text-articles were as follows: Type of studies (39 studies excluded) and interventions (15 studies excluded) did not match with the eligibility criteria; participants' characteristics (11 studies excluded) did not fit with the inclusion criteria defined for “type of participants”; and outcomes (17 studies excluded) that did not answer the review question.

Quality and risk of bias assessment

Risk of bias assessment was performed using a tool *risk of bias summary*, adapted from *Cochrane Guidelines for Systematic Reviews of Health Promotion and Public Health Interventions*,²⁶ that presents all the judgements in a cross-tabulation of study by entry, to assess the quality of studies. The risk of bias assessment was performed independently by 2 authors. This tool allows assessing the methodological quality of studies: qualitative research, randomized controlled trials, nonrandomized studies, quantitative descriptive studies, and mixed methods studies. Components assessed included selection bias, information bias, and bias on the analysis. A selection bias occurs when systematic differences between baseline characteristics of comparison groups were identified. Randomized sequence generation and allocation concealment can minimize this type of bias. The information bias could be minimized by blinding or masking the participants, staff, and outcomes. This was not considered an exclusion criterion if the results were not affected or if the researchers had provided similar cares to both groups. Bias in the analyses occurs when studies had losses in follow-up or withdrawals, which created missing data. Changing the post hoc outcomes or omitting some of the results could also contribute to the risk of an analysis bias.

Data extraction

Quantitative data extracted included information about intervention and study design, population and sample, outcomes related to the review question (weight management, dietary intake, food and nutritional knowledge, food and nutritional behavior), and outcomes' measurements.

Data synthesis and analyses

The included studies investigate the effectiveness and acceptability of Facebook only or multicomponent interventions, which include Facebook as a delivery tool. Thus, it was not possible to

perform a meta-analysis because of the heterogeneity in the study design, quality, intervention design, and populations. The quantitative findings of included studies were able to evaluate the level of participants' engagement and acceptability with the interventions and to measure the impact on nutrition-related outcomes.

The nutrition-related outcome of each study was classified as positive, neutral, or negative by comparing the aims and hypothesis of the studies with their reported results. Studies developed with an intervention and a control arm were classified as having positive outcome when their results reported improvements on the intervention arm participants compared with the control group participants. Studies that only include baseline and postintervention measures had a positive outcome when their results reported improvements compared with baseline measures. When there were no differences between groups or compared with baseline measures, the study outcome was classified as neutral. If control arm was the group with improved outcomes or if the intervention group had a negative impact on the outcome, it was classified as negative.

Engagement of the participants and the influence of compensatory gifts on the retention rate were evaluated to assess the feasibility of these interventions. "Compensatory/incentive gifts" englobed monetary contribution for participants who completed study measures/questionnaires/follow-up, gifts to incentivize the engagement with the intervention and cost allowances. The retention rate was calculated based on the number of participants at day 1 of the intervention and the number of participants at the end of the intervention and was compared between intervention with compensatory gifts and intervention that did not offer compensatory gifts to the participants. For multicomponent interventions, engagement was measured with the number of times participants "liked," commented, and posted in a Facebook group; responses to the events, progress in Facebook games, challenges met, and Likert-scale questions about the number of times they accessed the intervention page or group; and how often they read the entire intervention posts. Engagement measures differ if the intervention was delivery through a Facebook page, group, game, or chat. Facebook analytics was not available in groups, so users' engagement between studies cannot be compared.

Acceptability was measured through questionnaires about participants' satisfaction with Facebook as part of the intervention program. Satisfaction questionnaires and Likert scales were used to answer the following questions: "How useful was being a member of Facebook group?" "How often do you log into your group page?" "Have you enjoyed being part of your Facebook group?" "Have you shared Facebook group content with anybody else?" "Do you will recommend this program to friends, family?"

Results

Data extraction and management

A total of 4824 records were identified from the databases (*PubMed*: 217 records, *Web of Science*: 228 records, *Ovid*: 4211 records, *Scopus*: 81 records, and *Cochrane*: 87 records). Of these, 4405 records were retained after removing the duplicates. After screening all the titles and abstracts, 116 records were selected for full-text screening for eligibility criteria. In total, 18 studies were included (Fig. 1). Outcomes and study details were collected and described narratively using tables.

Included studies

A total of 18 studies were included in this systematic review. Table I, Appendix A (<http://links.lww.com/PBJ/A18>), presents the characteristics of the included studies: author, population, outcomes, intervention design, participants, retention, and study design. All the studies had dietary intake or food and nutritional knowledge or weight management as a primary outcome. This review included 13 randomized controlled trials (72%),^{27–39} 3 quasiexperimental studies (17%),^{40–42} and 2 case studies (pre-post without a control group) (11%).^{43,44} The shortest study duration was 15 days, and the longest was 33 months. The number of participants was <30 in 2 studies,^{28,43} >30 and <100 in 12 studies,^{29,30,34–42,44} >100 and <300 in 3 studies,^{32,33,35} and >300 in 1 study.³¹ Six studies were published until 2016^{28–31,35,40} and 12 between 2017 and 2019.^{32–39,41–44}

Assessment of risk of bias in included studies

The study quality was assessed using "risk of bias summary" (Table II, Appendix B, <http://links.lww.com/PBJ/A18>), making it possible to access the internal validity of the studies to determine whether bias was avoided. Some of the included studies were not randomized or had no allocation concealment, but authors considered the differences between groups in the analyses minimizing a possible selection bias, reason why they were included in this review.

Most of the included studies on this review did not perform blinding or masking to minimize some information bias. However, this was not considered an exclusion criterion if the results were not affected or if the researchers had provided similar cares to both groups. Bias in the analyses occurs when studies had losses in follow-up or withdrawals, which created missing data. A change in the post hoc outcomes or an omission of some results was not observed in included studies.

Measures of treatment effect

Aim 1: effectiveness in nutrition-related outcomes of Facebook-mediated interventions. The nutrition-related findings of the 18 included studies are described in Table III, Appendix C (<http://links.lww.com/PBJ/A18>). All these studies used scientific validated measures to assess their outcomes. No missing data were found. Most of the studies had weight management as a primary outcome (13 studies), and 1 study had weight management as a secondary outcome. Nutritional knowledge was the primary outcome of 2 studies and dietary intake of the other two. Regarding the total of 26 nutrition-related outcomes, positive effects were observed for 17, 8 were neutral, and 1 was negative (Table IV, Appendix D, <http://links.lww.com/PBJ/A18>). From the 14 studies that evaluate weight management, the intervention had a positive outcome in 7 studies, a neutral outcome in 7 studies, and a negative outcome in 1 study. The results showed that these interventions had a significant positive impact on postpartum women's weight loss. From the 7 studies that had dietary intake as an outcome, 6 had a positive impact of the intervention and 1 was neutral. Most of the studies' results showed a positive intervention effect, increasing the intake of fruits and vegetables and reducing the intake of sugar drinks and fried/fast foods. All the studies that measured food and nutritional knowledge (2 studies) and food and nutritional behavior (2 studies) had a positive result on this outcome.

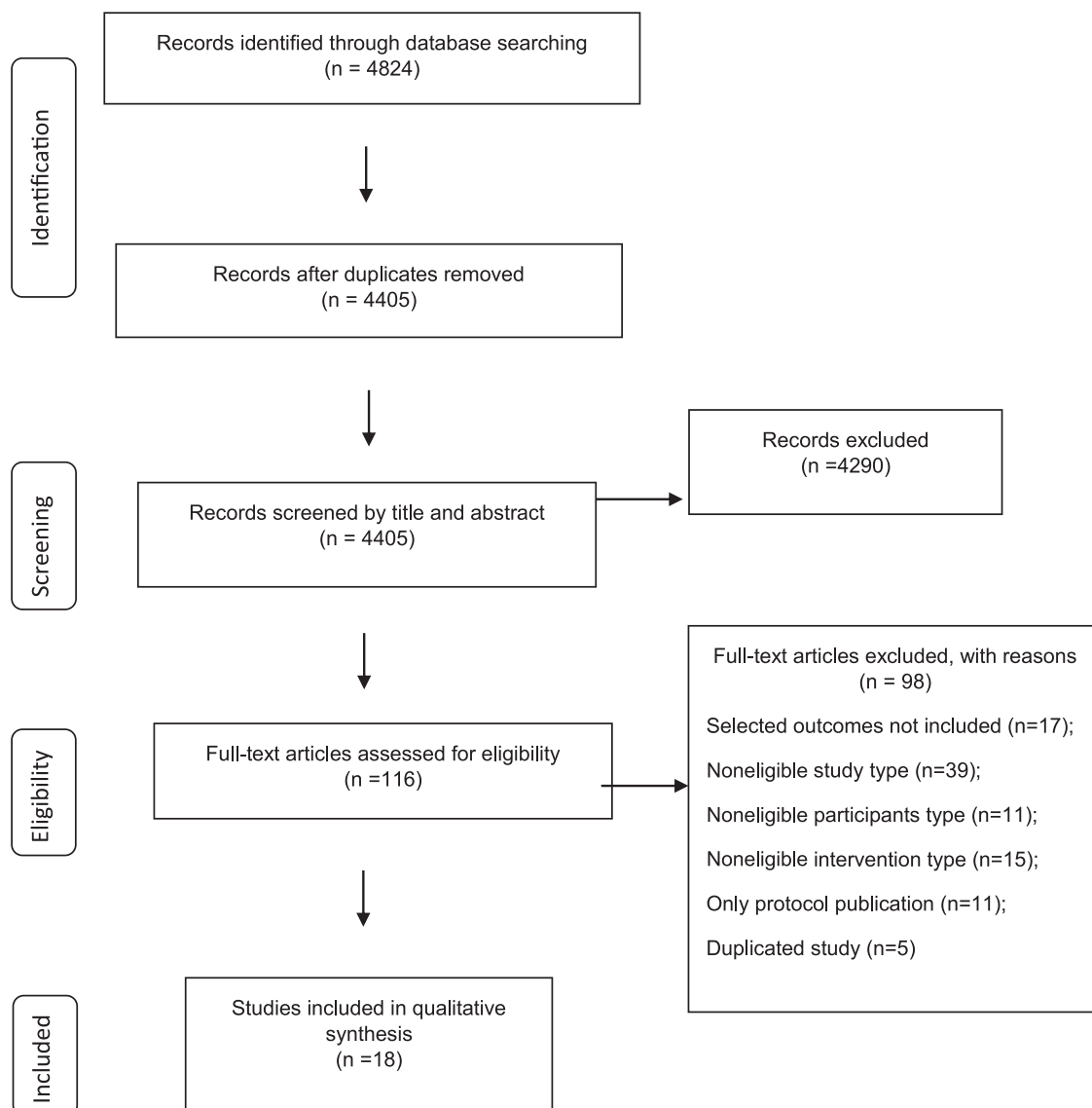


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flow diagram indicating the number of records identified, screened, included, and excluded.

Aim 2: relation between giving compensatory/incentive gifts to the participants and retention rate of nutritional intervention using Facebook. From the 18 included studies, 9 did not use gifts. The study by Hutchesson et al³⁶ had a retention rate of 100%, and gifts were not given. On the other hand, smallest retention rates occurred in studies that did not include compensatory/incentive gifts.

The retention rates of the studies are presented in Table V, Appendix E (<http://links.lww.com/PBJ/A18>), with a range between 39% and 100%. The retention rate of the study by Napolitano et al²⁷ was 96%, and participants were compensated monetarily for completed follow-up. The retention rate of the study by Fiks et al³⁴ was 82%, and each participant received a US \$50 monthly stipend for 2 months to offset the approximate cost of their phone data plan.

Aim 3: engagement of nutritional interventions using Facebook. Fourteen multicomponent studies examined engagement to the Facebook component, and the other 4 studies were only

delivery through this social network (Table VI, Appendix F, <http://links.lww.com/PBJ/A18>). Engagement had a large variation across the interventions; types of posts and the content seem to determinate the engagement level. Downing et al³³ described that the participant engagement was more frequent when posts were made by other participants, especially when the contents were photographs. In addition, the engagement seems to decrease overtime even if the investigators keep posting useful content for the behavior change. The study by Downing et al³³ found a decline in participant engagement: Initially, an average of more than 90% of the participants saw the posts; after the 13th post (15 months), it declined to less than 80%; there was a sharp decline after the 15th post to 32%. The study by Godino et al³¹ found similar results: 98 (9–265) interactions at 6 months, 76 (0–222) at 12 months, 41 (0–198) at 18 months, and 12 (0–161) at 24 months. These findings were also supported by Fiks et al³⁴: During the prenatal curriculum (7 weeks), there were 1953 participant posts across the Facebook groups, then 1802 from 0 to 3 months postnatal, 1074 from 3 to 6 months, and 553 from 6 to 9 months.

Aim 4: acceptability of nutritional interventions using Facebook.

Acceptability was measured in 15 of the included studies (Table VI, Appendix F, <http://links.lww.com/PBJ/A18>). Most of the participants in each study answered that the Facebook component of multimethod interventions was helpful, which will recommend the program.

Discussion

To the best of our knowledge, this is the first systematic review on dietary interventions using Facebook. Positive changes in dietary intake, food and nutritional knowledge, food and nutritional behavior, and weight management were observed in studies that used this social media as an intervention component, but it is not possible to conclude whether Facebook intervention was the major reason responsible for the positive results.

Facebook interventions allow some benefits in the recruitment, engagement, and retention of the participants throughout the study; however, data collection is mostly performed subjectively, and this may be a source of information bias. Interventions that also include a face-to-face interaction to collect baseline and postintervention data may have a smaller risk of bias and may produce more favorable results.³⁵

The results of the studies included in this review were not consistent about effectiveness for improving nutrition-related outcomes, such as dietary intake, food and nutritional knowledge, and food and nutritional behavior. It was possible to observe positive effects in weight loss, mostly in postpartum women and obese adults, but neutral effects were observed in weight management in most of the studies conducted to children and adolescents. Dietary intake had a positive effect, considering an increase in consumption of vegetables and fruits and a decrease in consumption of junk foods, sugar drinks, and fried/fast food. Food and nutritional knowledge was an outcome that should be studied more in social media interventions; even if the results showed the potential of this delivery tool to improve food literacy, studies were not enough to make any conclusion. Even if standard and validated tools were used to measure dietary outcomes, it was possible that participants misreported information.^{29,35,38} Longer follow-up period may be required to achieve cause-effect evidence that represents real-life behavior.^{16,32,38,40,42,43}

The retention rate could have a relation with compensatory/incentive gifts that were given to the participants in some interventions. However, it is not possible to conclude in this systematic review because of the heterogeneity across the included studies (follow-up time, sample size, intervention design, and participant characteristics).

Engagement measure used in most of the studies did not take into account the depth of those interactions: Liking a post about healthy eating on intervention Facebook's page was considered the same level of engagement as posting doubts or ideas. These types of measures did not quantify the common practice of lurking (passively consuming posts but not interacting in a visible way). Evidence suggests that people who use social media for information are more likely to read than to share, comment, or like.⁴⁵ Some studies reveal that interactive content is more effective to enhance engagement (challenges, videos, discussion forums, coaching sessions, goal setting, feedback), but content that improves nutrition knowledge (recipes, suggestions, news) and motivational messages are the most preferred.^{33,46} Interventions that include friendly competitiveness between participants for enhancing their goals also improve engagement.²⁹ The results revealed that engagement tends to decline over time in the

studies.^{30,44} One of the reasons presented for this is that participants' confidence and self-efficacy with dietary-related practices increase and their perceived need for advice declines.^{33,41} More research is needed to determine the definition and metric of engagement more credible to conclude about intervention effects.

Acceptability was measured with satisfactory questionnaires in most of the studies and had positive results. Trust seems to be an important predictor to improve acceptability to the content of Facebook nutritional interventions: Phrases such as "studies show" and "research finds" make posts more valid.^{7,33} Positivity and empowerment messages are effective at individual behavior change, raising awareness⁴⁷ and acceptability.

According to the collected data, it is not possible to answer the review question "Are Facebook nutrition-related interventions effective, feasible and acceptable for general population?", and this study does not allow us to conclude about the effectiveness of Facebook as a delivery tool for nutrition interventions because of the heterogeneity of the studies and results. The feasibility of Facebook interventions was supported by a significant retention rate, participant engagement, and participant acceptability. However, more studies are needed to assess the feasibility of nutrition interventions using Facebook as a delivery tool.

Cost-effectivity was measured merely on studies that used Facebook as a recruitment tool. Recruitment is often a difficult and costly procedure of research studies. Facebook seems to reach a large number of target people in a short time.⁴⁸⁻⁵⁰ Facebook paid advertisements is one of the solutions that this social media offers to enhance cost-effectivity.⁵¹⁻⁵³ Even if cost-effectivity was not measured in intervention studies, some of them suggest that using this social media can result in a decrease in research time and consequently potential costs.³³

Ethical concerns of using Facebook were assessed in some qualitative studies, which related that this social media often contains derogatory remarks pointing to weight stigmatization that can lead to cyberbullying. On the other hand, nutritional interventions mediated through this social media can allow participants to find the support they may lack in "real life,"⁵⁴ and the convenience and accessibility to diverse opinions from peers seems to be an important part of this support, allowing fight against stereotypical ideas and beliefs.⁵⁵ The requirement that participants need to have a Facebook account to participate in the interventions can be a bias-boosting factor because many potential participants have no interest in joining a social network or feel uncomfortable with sharing online information with strangers.³⁸ Protecting participants' privacy is another challenge to address, especially when collecting health and personal data.^{14,20,56} However, public is positively disposed to the use of their personal and health information to benefit general population.⁵⁷

Facebook interventions could address other ethical issues because this social media allows brands and companies to create profiles, generating a new marketing strategy, not only for those who choose to follow them but also through advertisements that reach the pages of millions of users.^{20,58-60} Exposure to these advertisements could be an ethical concern in dietary interventions using Facebook because it allows an uncontrolled contact with this kind of marketing, which could negatively influence participants' food behaviors. However, people can also be exposed to advertising when participating in face-to-face interventions. The public also have access to news in Facebook with inaccurate nutritional content, given them the perception that nutrition is about opinions and not about science, which may

increase consumers' confusion, skepticism, and avoidance of dietary advice.^{3,60} Therefore, nutrition experts and public health organizations need to reach social media to give the correct answer in real time to change food and health behaviors and beliefs.⁶¹

Facebook interventions were established as an effective medium for nutrition professionals to share information, promoting retention and engagement of the participants. The use of this social media over face-to-face interventions emphasized a need to reconsider traditional ways of communicating health messages and for health services to consider their social media policies. A more strategic and sophisticated strategy involving a longer follow-up period and a more representative sample should be used to further increase reach.

Implications for research and practice

Interventions using a Facebook component promote participants' engagement and are well acceptable for general population. Therefore, Facebook can be a very useful tool for health and education professionals. In the future, well-designed studies should be implemented to be able to conclude on the effectiveness attributed specifically to Facebook.

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Conflict of interest

The authors declare no conflict of interest.

Author Contributions

Vera Cunha was responsible for the work's conception, design, data collection, data interpretation, and analysis. Patrícia Padrão contributed to the work's conception and design and reviewed the article. Susana Montenegro participated in the critical revision of the article in a manner sufficient to establish ownership of the intellectual content.

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