

The Use of Smartphone as A Technology-Based Intervention on Managing Nutrition among The Obese Population: A Literature Review

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Article Info

Article history:

Received: Sep 18, 2023

Revised: Nov 14, 2023

Accepted: Nov 23, 2023

DOI: [10.58418/Ijni.V2i2.51](https://doi.org/10.58418/Ijni.V2i2.51)

How to cite this article:

Arifin, R. F., & Nallappan, D. (2023). The Use of Smartphone as A Technology-Based Intervention on Managing Nutrition among The Obese Population: A Literature Review. *International Journal of Nursing Information*, 2(2), 22–27.

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ABSTRACT

Smartphone apps have been used to promote healthy eating and weight management, as they offer low costs, reduce burdens, and overcome the limitations of traditional in-person programs. The aim of this research is to determine the use of smartphones as a technology-based intervention on managing nutrition. The review method focuses on the relationship between smartphones and healthy diet and nutrition, analyzing 178 articles published up to 2023. The review identified three qualitative studies and five randomized controlled trials investigating the effectiveness and acceptability of smartphone apps for promoting healthy eating and weight management. The results show that a study on the effectiveness of smartphone applications in promoting healthy eating and weight management found that middle-aged men in Australia support using the Internet for improving dietary habits and physical activity, as long as the interventions are user-friendly and efficient. However, they show low commitment to online activities and reluctance to use regular mobile phones for health behavior modification. The study also found that smartphone apps can be effective in promoting healthy eating and weight loss, making them a potentially valuable and cost-effective tool for improving dietary habits, nutrition, and combating obesity. In conclusion, Smartphone applications could serve as an effective and affordable method for improving dietary habits and tackling obesity among the general public. Measurements of diet and nutrition taken through mobile devices are often accurate. The contribution of this research is to increase smartphone users' knowledge to help in monitoring their food consumption and managing their weight.

Keywords: Technology-based Intervention, Smartphone, Nutrition Management, Obesity



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1. INTRODUCTION

Today, approximately 650 million adult people and approximately 340 million children and adolescents (5-19 years) suffer from obesity (Jankowska et al., 2021; Sørensen et al., 2022; Stavridou et al., 2021). The expanding predominance of weight and its affiliation with cardiovascular illness, a few types of cancer, diabetes, and other constant sicknesses have provoked intrigue in recognizing compelling ways to advance sound eating and weight control. There has been expanding consideration to utilize cell phone content informing and smartphone applications (apps) to advance solid eating and bolster weight misfortune (Pellegrini et al., 2015; Suganyadevi et al., 2022). Smartphone stages have brought down costs, diminished the burden to members, and overcome a few confinements of conventional in-person behavioral weight misfortune programs (Allen et al., 2013; Bommakanti et al., 2020; Pellegrini et al., 2015). Set up intercessions for weight misfortune are resource-intensive, a figure that postures boundaries

for full support and broad dispersal. Smartphone apps give a valuable and low-cost way to spread data around appropriate slim down and sustenance to the common populace and to specific at-risk populaces such as cancer survivors and individuals who are overweight or corpulent.

Numerous apps related to diet, nutrition, and weight management are accessible on popular smartphone platforms like iPhone, Android, Nokia, and BlackBerry (Chung, 2020; Joshua et al., 2022; Sobnath et al., 2017). Typical functionalities encompass providing feedback, setting goals for healthy eating, aiding in healthy cooking, assisting with grocery or restaurant choices, monitoring energy and nutrient intake, tracking weight, and facilitating social support and behavior change planning (Azar et al., 2013). Nevertheless, only a limited number of these apps have undergone testing to gauge their effectiveness in promoting health. Furthermore, most of these apps lack a foundation in health behavior change theories, do not incorporate evidence-based elements like reinforcement, and seldom adhere to evidence-based dietary and nutritional recommendations (Wearing et al., 2014).

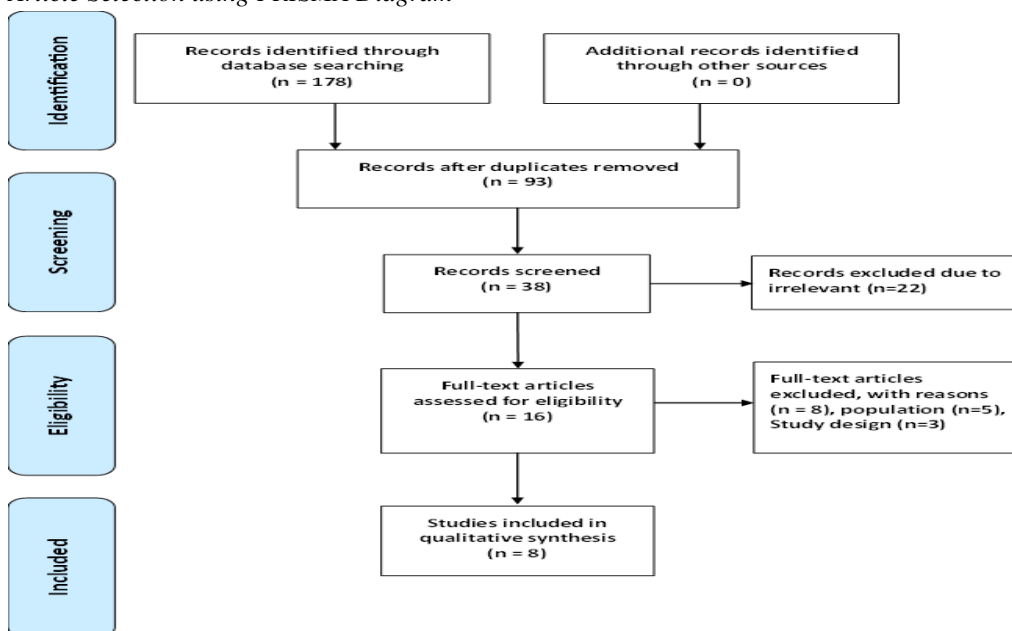
In this article, findings on the worthiness and viability of smartphone apps were outlined to advance appropriate count calories and nourishment or to lose weight. Of specific intrigue were randomized control trials of the adequacy of smartphone apps to advance solid eating. Moreover inspected were the comes about of subjective thinks about and assessments of the precision of eat less and sustenance estimations inferred by smartphone apps. Because of that, the research objectives is to determine the use of smartphones as a technology-based intervention on managing nutrition.

2. METHOD

This review is based on literature searches conducted in PubMed and CINAHL using specific search terms. In this study, articles published in English up to 2023 were identified by employing MeSH search terms and Boolean algebra commands such as ((diet weight) or (dietary) or (diet weight loss) or (dietary intake) or (nutritional) or (health nutrition) or (cancer nutrition)) and smartphones, as well as ((weight loss) or (weight gain) or (body weight) or (exercise weight) or (weight management) and smartphones). This study did not restrict searches to article titles and excluded studies focusing on chronic diseases other than obesity. The articles found in these searches were evaluated based on information like the title, abstract, study location, and keywords. Additionally, reports mentioned in Cochrane reviews (<http://community.cochrane.org/cochrane-reviews>) were identified and the references in reports and published review articles were reviewed.

In total, 178 article citations were found through these searches. Most of the published articles on smartphones and their relationship with healthy diet and nutrition emerged after 2011. After reviewing the abstracts or full texts of these articles, three qualitative studies and five randomized controlled trials that investigated the effectiveness and acceptability of smartphone apps for promoting healthy eating and weight management were identified. This review builds upon the previous work of other authors by incorporating recent studies and summarizing the findings of both qualitative studies and randomized controlled trials. Figure 1 below shows article selection using PRISMA diagram of 178 articles.

Figure 1
Article Selection using PRISMA Diagram



3. RESULTS AND DISCUSSION

3.1. Characteristic of Studies

The selected reports encompassed qualitative investigations that utilized focus groups and randomized controlled trials to assess the effectiveness of smartphone applications in enhancing dietary habits, nutrition, and weight management. Additionally, a few of these studies explored the precision of dietary and nutritional measurements conducted using smartphone devices and personal digital assistants (PDAs).

Vandelanotte et al. (2013) conducted a qualitative exploration focused on middle-aged men in Australia, aiming to understand their perspectives and attitudes regarding the utilization of Internet and mobile phone-based interventions for enhancing nutrition and physical activity. The study involved six focus groups with a total of 30 participants. The analysis revealed six main themes: (a) Internet experience, (b) characteristics of websites, (c) Web 2.0 applications, (d) features of websites, (e) self-monitoring, and (f) the use of mobile phones as a delivery method.

Using the mobile apps to improve and self-monitor their dietary habits and physical activity (Berry et al., 2021; Hahn et al., 2022; Ulfa et al., 2022), as long as the interventions delivered through websites were user-friendly and efficient. However, they exhibited relatively low levels of commitment to engaging in online activities. Additionally, Eppes et al. (2023), Milne-Ives et al. (2020) and Musgrave et al. (2023) stated use regular mobile phones to modify their health behaviors, with smartphones being more acceptable.

Robinson et al. (2013) developed and assessed the feasibility of an attentive eating intervention delivered through a smartphone app. The feasibility of the app was evaluated in a non-randomized 4-week trial involving 12 overweight and obese university staff members. Participants reported that the app heightened their awareness of their food consumption and found it easy to use.

Morrison et al. (2014) employed a mixed-methods approach to investigate two aspects: (a) individual variations in the impact of a weight management app called "POWeR Tracker" on self-reported goal engagement (motivation, self-efficacy, awareness, effort, achievement) when used alongside a web-based weight management intervention (POWeR), and (b) participant usage and perspectives regarding the weight management app. Thirteen adults were given access to POWeR and monitored for four weeks, with access to POWeR Tracker provided in alternating weeks. The participants recorded their daily self-reported goal engagement, while their usage of POWeR and POWeR Tracker was automatically tracked. Telephone interviews were conducted and analyzed using thematic analysis to explore participants' experiences with these tools. The researchers observed that access to POWeR Tracker was associated with an increase in participants' awareness of their food intake ($P=0.04$), although this effect varied among individuals. Participants spent a similar amount of time on the POWeR website during weeks when POWeR Tracker was available (mean 29 minutes, SD 31 minutes) compared to when it was not available (mean 27 minutes, SD 33 minutes). Qualitative data revealed that almost all participants found it more convenient to access information on-the-go through their mobile phones compared to using a computer.

3.2. The Effect of Various Smartphone Application on Nutrition and Dietary Pattern

Wharton et al. (2014) conducted an eight-week weight loss trial where participants monitored their dietary intake using one of three methods: a smartphone application called "Lose It!", the built-in smartphone feature, or the traditional paper-based method. While all three groups experienced weight loss during the study ($P=0.001$), there were no significant differences in the amount of weight lost between these groups. Smartphone app users ($n=19$) consistently recorded their dietary information more than the paper-based group ($n=15$; $P=0.042$), but there was no significant difference compared to the memo group ($n=13$).

To assess the feasibility, acceptability, and effectiveness of a behavioral intervention delivered through smartphone technology, Allen et al. (2013) randomly assigned 68 obese adults (average age 45 years, 78% female, 49% African American) to one of four groups: 1) intensive counseling, 2) intensive counseling plus smartphone, 3) less intensive counseling plus smartphone, or 4) smartphone intervention only. The study measured various outcomes, including weight, body mass index (BMI), waist circumference, and self-reported dietary intake and physical activity at baseline. Participants in the intensive counseling plus self-monitoring smartphone group and the less intensive counseling plus self-monitoring smartphone group tended to achieve more significant weight loss compared to the other groups (5.4 kg and 3.3 kg, respectively).

In a preliminary study, Martin et al. (2015) investigated the effectiveness of a smartphone-based weight loss intervention known as "SmartLoss." Adult participants (with BMI between 25 and 35 kg/m², mean age 44.4 years, 82.5% female) were randomly assigned to either the SmartLoss group ($n = 20$) or a health education control group ($n = 20$). The SmartLoss participants were instructed to follow a daily diet of 1,200 to 1,400 kilocalories and were provided with a smartphone, body weight scale, and accelerometer that transmitted data on body weight and step count wirelessly to a website. In the

SmartLoss group, mathematical models were used to assess dietary adherence based on body weight, and counselors remotely provided treatment recommendations based on this data. Meanwhile, the health education group received health tips via their smartphones. The SmartLoss group achieved significantly greater weight loss ($P < 0.001$) (least squares mean \pm SEM: $-9.4 \pm 0.5\%$) compared to the Health Education group ($-0.6 \pm 0.5\%$).

Carter et al. (2013) carried out a six-month trial to evaluate how well people accepted and could use a weight management program that was self-monitored and provided through a smartphone app. This was compared with similar interventions delivered through a website and a paper diary. A group of overweight individuals (128 in total) were divided randomly to use one of these three methods. The smartphone application, named 'My Meal Mate', was designed based on proven behavioral strategies. This app featured functions like setting personal goals, tracking diet and physical activity, along with weekly feedback through text messages. The website group accessed a slimming website offered by Weight Loss Resources, the same company that supplied the paper diaries.

In the Mobile Pounds Off Digitally (Mobile POD) weight-loss study, Turner-McGrievy & Tate (2011) investigated whether using podcasts, mobile support communication, and mobile tracking of diet could help adults reduce their weight. This study, which lasted six months and involved minimal direct contact, enrolled overweight participants (96 in total) through TV ads and email listservs. They were then randomly placed into two groups: one that only used Podcasts and another that combined Podcasts with Mobile support.

3.3. Discussion

The number of randomized controlled trials examining the effectiveness of smartphone applications in enhancing dietary habits, nutrition, and weight management remains limited, with some trials suffering from small sample sizes. Variations in study design, such as the choice of a comparison group and outcome measures, as well as differences in the functionalities of smartphone apps, complicate the ability to arrive at definitive conclusions regarding the effectiveness of these apps in influencing behaviors. Based on the findings of this review, it is found that the impact of these interventions, such as a reduction in BMI, is likely to be modest.

Nevertheless, smartphone apps offer several advantages (Aufa et al., 2023; Bauer et al., 2020; Nurfikri et al., 2023). The results of this review suggest that these apps can indeed be successful in promoting healthy eating and weight loss, making them a potentially valuable and cost-effective tool for improving dietary habits, nutrition, and combatting obesity within the broader population. Furthermore, validation studies have generally indicated that mobile devices can accurately measure diet and nutrition, which adds to their credibility (Michelle C. Carter et al., 2013; Lieffers & Hanning, 2012; Stumbo, 2013).

Further investigation is required to determine how effective different components of smartphone technology are in interventions (Dugas et al., 2020; Emberson et al., 2021; He et al., 2021; Pellegrini et al., 2015; Szinay et al., 2023). Upcoming studies should adopt randomized controlled trial methodologies, involve more participants, and extend the duration of the studies to more effectively assess the capacity of smartphones in diet and nutrition tracking and intervention. It is also essential to develop health messages that are culturally relevant and customized to enhance understanding and awareness of healthy behaviors like nutritious eating. Currently, there are no research-validated smartphone applications that are culturally adapted for non-English speakers or individuals with limited health literacy. Health promotion messages that are specifically tailored to a cultural group meet the distinct needs of its members, boost their engagement, are often seen as more directly applicable to them, and are more likely to result in changes in behavior. Customizing health promotion messages for specific cultural groups makes the messages more pertinent to the people they are intended for.

4. CONCLUSION

Smartphone applications could serve as an effective and affordable method for enhancing dietary habits and tackling obesity among the general public. Measurements of diet and nutrition taken through mobile devices are often accurate. Users favor apps that are simple and fast to use, especially those that help in monitoring their food consumption and managing their weight. It is essential to develop smartphone apps that are tested in research and customized for different cultures, as well as suitable for individuals with limited health literacy and for those who do not speak English.

ACKNOWLEDGEMENTS

The authors would like to thank the Lincoln University College and STIKes Sukabumi for supporting this research.

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