

Virtual Education Protocol for Sustainable Lifestyle Modifications

Abstract

Background: Family-based digital interventions have been shown to be effective in helping children and families adopt healthier lifestyles. This study aims to assess the efficacy of virtual educational programs in promoting lifestyle modification, with a focus on improving dietary habits, increasing physical activity, and reducing tobacco use among families in Isfahan, Iran. **Methods:** This study was carried out in two stages from 2023 to 2024. The initial phase involved a comprehensive review of the existing literature, alongside consultations with health experts, to standardize and develop intervention programs tailored to the cultural context of Iranian society. The second phase was a randomized intervention survey conducted in parallel and double-blind (participants and statistics specialist) manner in two groups. Eligible participants included families registered at health centers, with at least one child aged 6–15 years and access to the internet and electronic devices. Participants were randomly assigned to either the intervention or control group. In the intervention group, each family member received virtual educational content via a website or mobile app. The program was delivered weekly for the first 8 weeks, followed by biweekly sessions for the next 8 weeks. The content focused on improving dietary habits, increasing physical activity, and reducing tobacco use and smoking exposure. The control group received no educational interventions but was given access to the recorded sessions after the study concluded. Participants were followed up at 2- and 6-month post-intervention. **Results:** The primary outcomes include changes in body mass index (BMI), physical activity levels in both children and parents, dietary habits, smoking status, and exposure to indoor air pollutants. **Conclusions:** The rigorous design, incorporating cultural adaptation and a double-blind randomized controlled trial with follow-up assessments, provides a strong methodological framework for evaluating the effectiveness of virtual health interventions in a specific cultural context.

Keywords: Air pollutants, digital health, exercise, feeding behavior, life style, smoking

Introduction

In recent decades, lifestyle changes have affected different aspects of human health. Increased sedentary behaviors (SBs), unhealthy dietary habits, and tobacco usage have raised the prevalence of various non-communicable diseases (NCDs) such as obesity, hypertension, diabetes mellitus (DM), and cardiovascular diseases (CVDs). The prevalence of insufficient physical activity (PA) among 1.6 million adolescents was around 81%.^[1,2] According to a pooled analysis of 5.7 million adults, approximately one-third of them did not reach the recommended levels of PA.^[3,4] Tobacco use is one of the serious health crises worldwide, killing more than 8 million people per year, including an estimated 1.3 million secondhand smokers.^[5] According to the

report of the Centers for Disease Control and Prevention (CDC), in 2023 nearly 12.6% of high school students and 6.6% of middle school students use any kind of tobacco products.^[6] Dietary risk factors are another cause of NCDs, which are attributed to 11 million deaths and 255 million disability-adjusted life-years (DALYs). High sodium intake and low whole grain and fruit consumption were found to be the major dietary risk factors.^[7] According to the available literature, childhood obesity, and unhealthy dietary habits increase the risk of NCDs in adulthood.^[8]

Children and adolescents are engaging in risky behaviors. Thus, multifactorial behavioral interventions and educational programs are needed. These interventions were even more effective when including the parents.^[9] This might be due to the dependence of children and adolescents on their families. In addition, parents as the

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forefront caregivers considerably affect various aspects of children's lifestyles.^[10] Results of a meta-analysis of 36 randomized clinical trials demonstrated that family-based interventional programs significantly improved the youth's PA levels, and diminished screen time and discretionary food consumption.^[11] However, no significant effect was observed on smoking habits. Studies have utilized various multidisciplinary interventions based on cultural differences. Therefore, discrepancies were observed in their results.^[12]

After the COVID-19 pandemic, the role of remote education for various purposes has emerged.^[13] Studies have shown the efficacy, feasibility, and acceptability of virtual programs for lifestyle modification.^[14,15] Al-Badri *et al.*^[15] showed that for weight management, virtual lifestyle interventions are as effective as in-person programs. Additionally, digital interventions are low-cost and easy to use.^[13]

Due to the increasing prevalence of NCDs, modulating the mentioned risk factors is the best way to prevent them. So, we aimed to assess the efficacy of virtual educational programs on lifestyle modification in terms of improving dietary habits, increasing physical activity, and reducing tobacco use among families living in Isfahan, Iran.

Methods

Study design and participants

The present study was conducted in two stages from 2023 to 2024. In the first stage, by reviewing the existing literature and using the opinions of health experts, intervention programs were standardized and designed according to the culture of Iranian society. The second phase was a randomized intervention study that was conducted in parallel and double-blind (participants and statistics specialist) in two groups. Registered families at the health centers who had access to the internet and smartphone, or tablet, computer, or laptop, and had the skill to utilize them were eligible to be included. Included families must have at least one child aged 6 – 15 years, and both parents should be able to participate in virtual programs. Families with a handicapped member who could not take part in PA programs, take weight-lowering or weight-gaining drugs, or contribute to any kind of lifestyle modification programs, and families with a member of refractory disease that should have a special diet were excluded.

Included participants were randomly divided into control or intervention groups. Families were selected using the simple random method. Two healthcare providers were asked to contact the selected families and describe the aims of the study and intervention duration. The ability of families to utilize the internet for virtual sections and their accessibility to electronic devices were assessed. Then, to check their skills, families were asked to register at the website and complete the informed consent form.

Intervention

Our program aimed to improve different aspects of the lifestyle including PA, dietary habits, tobacco use, and indoor air pollutants. In the intervention group, each person (child, father, mother) receives a specific virtual educational program through a website or mobile phone application. One specialist designed the website and application. Health professionals provided content in each intervention area. The online interventions were held each week for 8 weeks, and then every two weeks for the next 8 weeks. Each section lasts 90 minutes. Sections were recorded and participants could also watch the program offline. Trainers consisted of pediatricians, nutritionists, and public health specialists. The level of the educational programs was regulated according to the socioeconomic status and educational level of the families. The training focused on limiting the consumption of high-fat/high-sugar foods (referred to as “red foods”) and increasing the intake of fruits and vegetables, as well as modifying food purchasing behaviors to ensure healthy snacks were available to the family. Children and adults were encouraged to follow a balanced diet based on the food pyramid. Physical activity was promoted through a mobile health program utilizing a pedometer for all participants. Both children and parents were encouraged to monitor their physical activity and gradually increase their daily steps. Participants were trained in self-monitoring and goal-setting techniques. Parents were encouraged to minimize sedentary behaviors and reduce television watching time. A website and app were used to deliver completed programs, either with text or animations, providing motivational messages and reinforcing behavioral changes weekly over the 16-week duration of the training. To enhance family group participation, groups were formed through platforms like Eitaa, where parents shared challenges, issues, and successes related to implementing the educational programs. Researchers offered counseling on any matter requiring expert advice. Additionally, weekly educational messages related to the training topics were posted in these groups. During the training sessions, in addition to individual counseling by a psychologist, participants were encouraged to reduce or quit smoking and hookah use. Furthermore, they received training on reducing the use of indoor pollutants such as various incense and sprays.

A section of the website and application was designed with engaging educational content in vibrant colors, specifically targeting children from households. Additionally, some of the educational materials were presented in animated formats. To encourage children, rewards were established, which would be granted if the provided training led to behavioral changes in their lifestyle. Participants could contact trainers and ask their questions. Besides, to ensure participant compliance, the executive supervisor conducted weekly phone calls to monitor the progress and implementation of the training provided.

The control group did not receive any educational programs. At the end of the study, the recorded sections were accommodated to them.

Measurements

The baseline characteristics of the participants such as age, gender, educational status, body weight, height, body mass index (BMI), smoking status, PA levels, indoor air pollutants status, and dietary habits were collected. Height (cm), and weight (kg) were measured using standard calibrated instruments while participants wore thin clothes and no shoes. Weight and height were measured with an error of 0.2 kilograms and 0.5 centimeters, respectively. Based on the BMI z-scores calculated and categorized according to the World Health Organization (WHO) growth standards, participants were classified as underweight (BMI z-score of less than -2 standard deviations (SD)), normal weight (z-score ranging from -2 SD to $+1$ SD), overweight (z-score exceeding $+1$ SD), and obese (z-score greater than $+2$ SD).^[16] Weight measurements were done at the baseline and after the intervention. The Persian version of the international PA questionnaire (IPAQ) for adults, and the PA questionnaire child (PAQ-C) and adolescents (PAQ-A) were utilized to evaluate the PA levels before and after the intervention. The validity and reliability of the questionnaires were assessed elsewhere.^[17,18] Dietary habits were evaluated through questionnaire^[19] for dietary fat intake and questionnaire for dietary fiber intake.^[20] The fat dietary questionnaire consists of four subscales: The stages of change scale, the self-efficacy questionnaire, the decisional balance scale, and the processes of change questionnaire. The content and face validity of these questionnaires were evaluated and confirmed.^[19] The duration and the amount of cigarette smoke per day were inquired from the parents. Additionally, information regarding exposure to indoor pollutants, such as various types of incense and sprays, was collected. The status of exposure to tobacco smoke (secondhand smoke) was also gathered.

Outcomes

Variables were assessed at the beginning and at the end of the intervention. Participants were followed up for 2 and 6 months after the end of the survey. The main outcomes of the study were BMI PA levels, dietary habits, smoking status, and indoor air pollutant exposure.

Ethical approval

The study protocol was in accordance with the Declaration of Helsinki and was approved by the research and ethics committee of Isfahan University of Medical Sciences (IR.ARI.MUI.REC.1401.290). A written informed consent form was obtained from parents, and oral assent was obtained from their children after the aims and procedures were explained.

Discussion

Family-based lifestyle interventions (FBLI) are recognized as effective strategies for improving health outcomes by promoting health education and encouraging healthier behaviors. The family plays a pivotal role in shaping and sustaining children's habits related to diet, physical activity, and leisure activities. The parent-child relationship profoundly influences a child's development, including their behaviors, food choices, and exercise habits. Therefore, it is crucial for parents and caregivers to actively participate in initiatives that promote healthy eating and physical activity during childhood.^[9,21]

Nowadays, especially after the COVID-19 era, digital interventions have been used widely for modifying detrimental health behaviors to promote a healthier lifestyle.^[22,23] Digital interventions and virtual education for promoting healthy lifestyles offer innovative solutions with several advantages. First, all individuals, even people residing in remote areas, have the same access to healthcare providers and programs. Second, it is low-cost, easy to use, and has been extensively integrated into society. Moreover, these interventions can be scaled up to reach large populations, providing benefits to individuals in diverse geographic locations. Third, these materials often include both written and visual components, which enhance engagement and retention, facilitating effective learning through its enhanced capacity to embed itself in the brain's long-term memory. Consequently, it exhibits significant potential to influence changes in health-related behaviors among populations with different socioeconomic levels.^[24]

According to the results of a systematic review, FBLI demonstrated beneficial effects in the management of childhood obesity and was well-received by parents. Utilizing social media and gamification was shown to increase their efficacy. Further longitudinal investigations are necessary to ascertain the long-term efficacy and sustainability of this approach, as well as to determine if a combination of virtual and in-person methods may emerge as the preferred best practice moving forward.^[25] Another review study indicated that internet-based group interventions were effective in modifying a range of health behaviors such as smoking cessation, increasing physical activity, and addressing obesity. This method provides a scalable and cost-efficient way to implement behavioral interventions.^[26] Studies have shown that combining group therapy-based interventions with individual behavioral counseling and messages based on the planned behavior model can be particularly effective for smoking cessation, even when delivered through digital platforms.^[27-29] In addition, a retrospective study demonstrated a superior efficacy for virtual enhanced lifestyle interventions versus in-person in diminishing weight.^[30] The prevalence of mobile technology may contribute to this phenomenon. Nevertheless, the design and structure of digital

interventions can vary significantly, which can greatly affect the results, thereby complicating the evaluation of outcomes across different studies.

While digital platforms like FBI offer many opportunities, it's essential to acknowledge that access to technology can vary significantly across different demographics and regions, limiting the reach and effectiveness of such interventions. Additionally, user engagement can be a barrier, especially if individuals lack digital literacy, face technological barriers, or have low motivation to participate. Exploring these issues in more detail would certainly provide a more comprehensive understanding of the complexities surrounding digital interventions.

Conclusions

Given the increasing prevalence of risk factors for NCDs such as poor diet, sedentary lifestyles, and obesity, the promotion of healthy habits from childhood and the implementation of interventions for lifestyle modification are essential. Considering the critical role of parents and caregivers in shaping children's lifestyle choices, addressing their own lifestyle changes is equally important. Web-based education has emerged as an effective tool for promoting healthy behaviors within families by offering accessible, personalized resources and support, while also playing a key role in the delivery and scaling of lifestyle interventions across diverse populations.

Ethical approval

The study protocol was approved by the research and ethics committee of Isfahan University of Medical Sciences (IR.ARI.MUI.REC.1401.290).

Consent to participate

A written informed consent form was obtained from parents, and oral assent was obtained from their children after the aims and procedures were explained.

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Conflicts of interest

There are no conflicts of interest.

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