Journal of Adolescent Health 54 (2014) 631–645

ELSEVIER

JOURNAL OF ADOLESCENT HEALTH

www.jahonline.org

Review article

Impact of Computer-Mediated, Obesity-Related Nutrition Education Interventions for Adolescents: A Systematic Review

Whitney N. Ajie, M.S. *, and Karen M. Chapman-Novakofski, Ph.D., R.D., L.D.N.

Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, Illinois

Article history: Received September 3, 2013; Accepted December 17, 2013

Keywords: Adolescent; Systematic review; Internet; Computer based; Computer mediated; Intervention studies; Nutrition education; Overweight; Obesity

A B S T R A C T

Purpose: The purpose of this systematic review was to evaluate recent research regarding the use of computer-based nutrition education interventions targeting adolescent overweight and obesity.
Methods: Online databases were systematically searched using key words, and bibliographies of related articles were manually searched. Inclusion/exclusion criteria were applied and included studies evaluated for their ability to achieve their objectives and for quality using the Nutrition Evidence Library appraisal guidelines for research design and implementation.
Results: Of the 15 studies included, 10 were randomized controlled trials. Two studies targeted weight loss, 2 targeted weight maintenance, and 11 targeted dietary improvement with or without physical activity. At least half of in-school (60%) and nonschool interventions (80%) exhibited significantly positive effects on nutrition- or obesity-related variables. Small changes in diet, physical activity, knowledge, and self-efficacy were shown; however, few results were sustained long term.
Conclusions: Recommendations included application of health behavior theory and computer tailoring for feedback messages. Future research should include thorough description of intervention content (messages, theory, multimedia, etc.), application of rigorous methodology, as well as consideration of covariates such as parental involvement and gender. With further research and evidentiary support, this approach to obesity-related nutrition education has the potential to be successful.

IMPLICATIONS AND CONTRIBUTION

Computer-mediated nutrition education programs for adolescents show small, mainly short-term, changes in obesity outcomes, for example, body mass index (BMI), diet, nutrition knowledge, and physical activity. Future interventions may benefit from health behavior theory and computer-tailored feedback yet should also adhere to rigorous research methodology and consider mediating factors, for example, gender and parental involvement.

The prevalence of overweight in adolescents continues to be a public health concern. The 2009–2010 National Health and Nutrition Examination Survey revealed that 18.4% of adolescents aged 12–19 years were obese [1]. In 2011, the Centers for Disease Control and Prevention estimated that 15% of high-school students were overweight and 13% were obese [2]; furthermore, among certain at-risk ethnic groups, the figures were almost double the national average [3]. The short- and long-term co-morbidities of adolescent overweight and obesity are numerous: insulin resistance and hyperinsulinemia, type 2 diabetes, hyperlipidemia, lowered high-density lipoprotein cholesterol, hypertension, gallstones, sleep apnea, asthma, depression, and anxiety [4]. In addition, adolescent obesity has been associated with higher school absenteeism [5] and lower quality of life [6]. Improving nutrition and related health behaviors can alleviate some or all these conditions; however, prevention remains a top strategy to combat adolescent overweight and obesity. Global trends are similar to the United States, with child and adolescent overweight increasing especially in urban areas [7]. Therefore, nutrition education focused on obesity prevention in youth is a global public health priority. Because adolescence is marked as a crucial risk period for the

* Address correspondence to: Whitney N. Ajie, M.S., Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, 905 S. Goodwin Ave., Bevier Hall 238, Urbana, IL 61801.

E-mail address: whitney.ajie@gmail.com (W.N. Ajie).

1054-139X/$ – see front matter
http://dx.doi.org/10.1016/j.jadohealth.2013.12.019

development of obesity and its related consequences, targeting obesity at the threshold of adulthood is critical [8].

To target nutrition in adolescents, it has been suggested that interventions have a behavioral focus and use innovative multimedia technology tools [9]. With the wide reach of computers and Internet both inside and outside of school and their heavy use among adolescents, it follows that nutrition education would benefit from computer-based delivery. Nearly 90% of adolescents use the Internet, with computer usage and communications tools continuing to increase among youth [10,11]. Computers are available in 97% of U.S. schools, with Internet access available for over 90% of computers in schools [12]. In addition, slightly more than 75% of households had computers in 2011 [13]. Therefore, computers are a resource for learning at home and at school.

Previous computer interventions for adolescent health have targeted smoking cessation, HIV prevention, alcohol abuse, as well as teenage pregnancy prevention [14–19], and this method has grown in popularity within the last 10 years. As the prevalence of overweight and related disease in youth has increased, so has computer-based program development and implementation for nutrition education. Computer interventions have the potential to provide standardized and effective program transmission, as well as the speed of technology. However, research to support the programs' overall impact has yet to catch up.

Therefore, the objective of this systematic review was to evaluate the overall effectiveness of computer-based interventions that provided nutrition education related to adolescent overweight prevention or treatment. To do so, the specific aims were to evaluate the success of each intervention in achieving their objectives, based on their reported statistically significant outcomes ($p < .05$) and if those effects were sustained at follow-up; to identify which intervention characteristics were associated with improvement of nutrition- and/or obesity-related outcomes; and, based on the body of evidence, to ascertain limitations of research and recommendations for research and practice.

Methods

Literature search

A systematic literature search (Figure 1) was conducted via five Internet databases (PubMed, CINAHL, Google Scholar, Proquest, and Scopus). In addition, a manual search of relevant material was conducted to prevent overlooking possible entries. The manual search included articles with related content that were electronically suggested during the online search; bibliographies of accepted articles and related review articles; and online journal archives with content related to health, obesity, nutrition, technology, and communication. The National Library of Medicine's Medical Subject Headings search terms and non-Medical Subject Headings terms were included in a combination of at least one key term from each sublisting: (1) web based, Internet, Internet-based, online, computer, and computer based; (2) adolescent and youth; and (3) diet, nutrition, intervention, nutrition intervention, obesity, obesity prevention, weight loss, weight maintenance, weight management, and health promotion.

To be included, articles must have (1) an adolescent sample population between 7th and 12th grades or 12–18 years of age; (2) implemented an Internet- or computer-based education or behavioral intervention via a stationary or laptop computer; (3) published between January 2002 and August 2013; (4) employed a randomized controlled trial (RCT), quasi-experimental trial, or intervention with no concurrent control; (5) published in a peer-reviewed journal; and (6) written in English. Both theory-based and nontheoretical interventions were included. Studies must have measured nutrition-related outcomes (e.g., diet composition and nutrition knowledge) and/or obesity-related outcomes (e.g., BMI, BMI *z*-score, weight, and sedentary behavior). Study designs that included one or more parents were considered only if the primary target of the research was the adolescent. Studies that included noncomputer adjunct components and/or social or environmental changes were considered only if the main method of intervention was the computer-facilitated program. Exclusion criteria included the following: (1) interventions with >50% noncomputer component(s); (2) a study population <7th or >12th grade, or <12 or >18 years of age; (3) a focus on physical activity only; and (4) articles that were not peer reviewed.

Quality ratings

Each article was reviewed separately by the two authors using the U.S. Department of Agriculture (USDA) National Evidence Library's (NEL) appraisal guidelines for research design and implementation [20] and given a quality rating of positive, negative, or neutral. The two reviewers convened to finalize quality ratings and to complete a cross-sectional review of four weighted validity questions to confirm that these were graded consistently and accurately. The authors used the Conclusion Grading Chart developed by the 2010 Dietary Guideline Advisory Committee to determine a grade for the body of evidence [21].

Results

An intermediate review of 33 articles was conducted by each author, and 18 articles were excluded. The remaining 15 articles underwent a full review during which a detailed evidence worksheet was assembled (Table 1) and quality assessed revealing 10 positive ratings, three neutral, and two negative. The body of evidence received a grade of "Limited".

Most studies focused on a 7th to 8th grade population; six included high–school-aged students [22–27]. Half of the interventions targeted adolescent subpopulations including low-income minorities, minority females, overweight/obese adolescents, or overweight/obese minorities [22,23,28–32]. Two interventions targeted disordered eating behaviors, including overeating and binge eating, in addition to instruction on healthy eating and lifestyle behaviors [22,23]. Twelve programs focused on multiple nutrition-related energy balance behaviors, whereas the remaining three focused on either fruit and vegetable (F/V) consumption [32,33] or dietary fat [34]. Eight interventions also added strategies and/or feedback to increase the amount of physical activity [24,26,27,29–31,35,36].

Significant findings ($p < .05$) are reported below. Gender differences and sample sizes for intervention (I) and control (C) groups are given when available. Follow-up times are listed as time since post-treatment assessment.

Impact on nutrition- and obesity-related outcomes

Randomized controlled trials for weight loss (n = 2). In an earlier report, Williamson et al. [37] indicated that during the first 6 months, adolescents decreased their percentage body fat (I: −1.12%; C: +.43%). In the 2-year report [28], at 6 and 12 months,