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Research review

Technology-based interventions in the treatment of overweight and obesity: A systematic review

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ABSTRACT

The prevalence of obesity increases worldwide. The use of technology-based interventions can be beneficial in weight loss interventions. This review aims to provide insight in the effectiveness of technology-based interventions on weight loss and quality of life for patients suffering overweight or obesity compared to standard care.

Pubmed, PsycInfo, Web of Science, ScienceDirect, CINAHL and Embase were searched from the earliest date (of each database) up to February 2015. Interventions needed to be aimed at reducing or maintaining weight loss in persons with a body mass index (BMI) $\geq$ 25 kg/m^2 and have a technology aspect. Cochrane Collaboration's tool for assessing risk of bias was used for rating the methodological quality.

Twenty-seven trials met inclusion criteria. Thirteen studies showed significant effects on weight loss compared to controls. Most interventions used a web-based approach (42%). Interventions were screened for five technical key components: self-monitoring, counsellor feedback and communication, group support, use of a structured program and use of an individually tailored program. All interventions that used a combination of all five or four components showed significant decreases in weight compared to controls. No significant results for quality of life were found. Outcomes on program adherence were reported in six studies. No significant results were found between weight loss and program adherence.

Evidence is lacking about the optimal use of technology in weight loss interventions. However, when the optimal combination of technological components is found, technology-based interventions may be a valid tool for weight loss. Furthermore, more outcomes on quality of life and information about the effect of technology-based intervention after bariatric surgery are needed.

1. Introduction

The worldwide prevalence of obesity has more than doubled between 1980 and 2014. Globally, 39% of adults were overweight and 13% of all adults were obese in 2014 (WHO, 2015). Overweight and obese people have an increased risk for diseases such as coronary heart disease, type 2 diabetes, hypertension or dyslipidaemia (CDC, 2015). Technological development makes home- and market-production more sedentary, which causes people to be less physically active in general, and food prices are lower through agricultural innovation. This has led to weight gain an reduced exercise behaviour in the general population (Lakdawalla & Philipson, 2009). Although advances in new technology have had some negative effects on health, new technology also has the potential to improve health (Thomas & Bond, 2014).

Eysenbach (2001) describes eHealth as 'an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies'. As the technical capacity of the Internet grows, it becomes better able to offer a feasible medium for health behaviour interventions and research (Atkinson & Gold, 2002). Approximately 4.5% of all searches on the web might be health-related (Eysenbach & Kohler, 2004). The use of eHealth or technology-based interventions has several potential advantages. For example, it gives the opportunity to tailor information to the specific needs of individuals. Furthermore, it improves the capability of combining a variety of media to address the particular purposes of the intervention and it increases the possibility for users to remain anonymous and receive support from peers or experts about sensitive health issues (Atkinson & Gold, 2002).

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Technology-based clinical trials for overweight or obesity have demonstrated beneficial effects on weight loss. Multiple reviews are done on the effects of eHealth or technology-based interventions on weight loss (Bacigalupo et al., 2013; Thomas & Bond, 2014; Tufano & Karras, 2005; Wieland et al., 2012). However, these are limited to certain types of technology-based interventions, such as the use of computers or mobile phones. Furthermore, they only focus on weight change. Research shows that weight loss can have a positive effect on Quality of Life (Kolotkin, Meter, & Williams, 2001). In addition, program adherence can mediate the effects of the intervention on weight loss (Boutelle & Kirschenbaum, 1998). Thomas and Bond (2014) state that the use of electronic tools may encourage superior adherence compared to, for example, paper diaries. Currently, both health insurance companies and patients are interested in the use of modern eHealth, but gaps in information about eHealth and its working mechanism need to be clarified. Furthermore, health insurance companies need to have this knowledge to be able to give compensation for this type of care. This review aims to provide insight in the available evidence regarding technology-based interventions for overweight or obese adults and their effects on weight change, adherence and quality of life.

2. Methods

A systematic literature search was conducted. The patient population of interest consisted of patients with overweight, obesity or morbid obesity. The interventions studied were technology-based compared with standard care. Outcome measures were weight loss, Quality of Life and program adherence.

2.1. Search strategy and data sources

Pubmed, PsycInfo, Web of Science, ScienceDirect, CINAHL and Embase were searched from the earliest date (of each database) up to February 2015. No grey literature was searched. The search string used for the literature search, used a combination of the following keywords (or Mesh headings) and was modified for each database: (Telemedicine OR eHealth OR Technology-based) AND (Overweight OR Obesity) AND (Weight loss OR Quality of Life OR adherence). Full search strategy for each database can be found in Appendix 1.

Authors LR and SP separately screened and selected studies based on title and abstract. After primary selection, authors (LR and SP) reviewed the full text of each study and determined suitability for inclusion, according to established inclusion criteria discussed below. For additional eligible studies, cross-references were screened. Disagreements were solved by discussion with each other or with the senior author (SN) if necessary.

2.2. Inclusion criteria

Studies were eligible and considered to be of acceptable quality if 1) study participants were 18 years or older; 2) study participants were overweight, obese or morbidly obese, defined respectively as having a Body Mass Index (BMI) of >25 kg/m^2, ≥30 kg/m^2 and ≥40 kg/m^2 (WHO, 2015); 3) interventions had a technology aspect; 4) interventions aimed at reducing weight or maintaining weight loss; 5) data on weight change were provided. The technology aspect is defined as the use of Internet-based weight management tools, social media, apps for smartphones, telephone and/or smartphone/mobile phone use in general or active video games. The comparison group consisted of standard care, usual care, or wait-list control. Standard or usual care consisted mostly of a lifestyle intervention and/or counselling without technology aspects. The selected primary outcome was weight loss. Selected secondary outcomes were Quality of Life and program adherence. Study designs included all needed to have a control group without technological aspect, such as randomised controlled trials, cohort studies, cluster randomized controlled trials and quasi-experiments.

2.3. Methodological quality of included studies

For rating of the methodological quality, the Cochrane Collaboration's tool for assessing risk of bias was used (Higgins et al., 2011). This tool assesses the risk of bias on 6 domains: random sequence generation, allocation concealment, blinding, incomplete outcome data, selective reporting or other bias. Quality of methodology was scored by a '+' for a low risk for bias, '?' for an unclear risk of bias, and '−' for a high risk for bias. Two authors (LR and SP) separately assessed the methodological quality of the included studies.

To determine the level of agreement between authors LR and SP, a Cohen's kappa score was calculated. For research purposes, the Cohen's kappa should be at least 0.70 (Wood, 2007).

2.4. Data extraction

From the studies that met the inclusion criteria, detailed information such as study and intervention characteristics were extracted individually by two authors (LR en SP), as well as outcome data. To review the characteristics of the studies, the following information was extracted: the country where the study was conducted, the size and description of the study population, the intervention group, the comparison group, outcome measures and study design. Reviewers were blinded for journal and authorship.

When the data in the studies could not be presented in a consistent format and systematic reporting of comparable outcome variables was lacking, a meta-analysis was not conducted and only a systematic review will be undertaken. Effect sizes of the weight changes between the intervention with technological aspect and control were obtained by dividing the change scores by the standard deviations (SD) of the control group. Effect sizes are reported in SD units of change. Changes between intervention and control group were considered to be trivial (<0.2), small (0.2 to <0.5), moderate (0.5 to <0.8) or large (≥0.8) (Cohen, 2013).

3. Results

3.1. Study selection

The database search resulted in 365 records. Six additional record was identified through other resources. After removing duplicates, 332 records remained. After screening on title and abstract 39 full-text articles remained and were assessed for eligibility. Of these, 12 articles were excluded for various reasons. Two were excluded because they were a protocol of an intervention (Duncan et al., 2011; de Zwaan et al., 2012). Furthermore, three were excluded because the study population did not have a BMI of 25 kg/m^2 or higher (Estabrooks & Smith-Ray, 2008; Hutchesson et al., 2014; Orsama et al., 2013), two studies showed no weight change outcomes (Styn et al., 2012; Vadheim et al., 2010) and one study was not aimed at adults (Styn et al., 2012). Four studies were excluded because the control group received an intervention with technology aspect(Carter, Burley, Nykjaer, & Cade, 2013; Laing et al., 2014; Shaw et al., 2013; Steinberg, Levine, Askew, Foley, & Bennett, 2013). Twenty-seven trials met inclusion criteria (Agras, Taylor, Feldman, Losch, & Burnett, 1990; Allen, Stephens, Dennison Himmelfarb, Stewart, & Hauck, 2013; Appel et al., 2011; Blomfield