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Review Article

A systematic review of the long-term effectiveness of work-based lifestyle interventions to tackle overweight and obesity

Greta Tam*, May P.S. Yeung

Jockey Club School of Public Health and Primary Care, The Chinese University of Hong Kong, Hong Kong

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ABSTRACT

Obesity is one of the five leading global risks for mortality, accounting for 5% of deaths worldwide. Workplace health promotion programs have the potential to deliver population-level interventions combining physical activity and exercise. However, there is no recent critical review of trials on long-term effectiveness of multi-component lifestyle interventions in the workplace targeting obesity. Good quality evidence is needed to develop optimal strategies to tackle adult obesity. 1035 studies were retrieved by literature search in MEDLINE, Embase, PSYCH INFO and Cochrane library from 2005 to September 2016. 11 studies were identified, which were critiqued using 2010 CONSORT guideline. Most of the studies were not high quality. Five studies reported positive findings. Many studies included environmental interventions, but only two showed significant Body Mass Index (BMI) reduction. Studies showing significant BMI reduction were of high intensity or included a specific motivational component. Although there is some evidence demonstrating long-term effectiveness of multicomponent lifestyle interventions in the workplace targeting obesity, more research is needed into the best methods of conducting these interventions. This study provides evidence that could be used as the basis for implementing similar programs.

1. Introduction

Obesity is one of the five leading global risks for mortality, accounting for 5% of deaths worldwide. In high-income countries, obesity is the third leading cause of Disability-adjusted Life Years (World Health Organizations, 2017a). Raised Body Mass Index (BMI) is associated with increased risk of cardiovascular disease, diabetes, osteoarthritis and cancer (World Health Organizations, 2017b). Worryingly, there has been an increasing prevalence of overweight and obese adults, up to 69% in USA (Centers for Diseases Control and Prevention, United States, 2017a), 39% in Hong Kong (Centre for Health Protection, Hong Kong, 2017) and no national success stories in the past few decades (Ng et al., 2014). This global pandemic has led WHO to introduce a target to halt the rise in obesity by 2025 (Roth et al., 2004; Popkin et al., 2012; Swinburn et al., 2011).

In developed countries, the problem of obesity is compounded by the increasingly sedentary nature of jobs (Cawley, 2014), where most adults spend a substantial amount of time (Baicker et al., 2010). In addition, certain working populations are exposed to work stressors that are associated with obesity. These include night shift work (Karlsson et al., 2003), job strain (Georges et al., 1992) and long work hours (Belkic and Nedic, 2007). WHO recommends workplace health

promotion programs, which could deliver population-level interventions (World Health Organizations, 2017c). CDC recommends multi-component interventions which include nutrition and physical activity (Centers for Diseases Control and Prevention, United States, 2017b). In evaluating their effectiveness, randomized controlled trials offer the best level of evidence (Centre for Evidence-Based Medicine, 2017). To truly tackle obesity, not only is weight-loss essential, but its long-term maintenance, defined as at least 1 year (Institute of Medicine, 1995) is equally important.

This study aims to systematically review literature for randomized controlled trials of combined nutrition and physical activity interventions in workplace settings where the population is overweight or obese, with at least one year follow-up. By evaluating the evidence for effectiveness, this study will provide information for optimal strategies to tackle adult obesity.

2. Methods

Studies were identified by literature search in multiple databases, including MEDLINE, Embase, PSYCH INFO and Cochrane library from 2005 to September 2016. Reference lists of systematic reviews were also reviewed for additional articles. A combination of expanded

* Corresponding author at: Room 404, School of Public Health and Primary Care, Prince of Wales Hospital, Shatin, Hong Kong.
E-mail address: gretatam@cuhk.edu.hk (G. Tam).

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keywords including “obesity OR overweight” AND “workplace OR worker OR employee” AND “diet OR nutrition OR lifestyle OR exercise OR physical activity”.

Selection of studies was based on several inclusion and exclusion criteria. Inclusion criteria include: 1) Randomized controlled trials; 2) Overweight population (mean baseline BMI ≥ 25); 3) Onsite workplace intervention including both dietary and exercise components; 4) Follow up of at least 1 year and 5) Changes in BMI as outcome measure. While exclusion criteria include: 1) Subjects with known medical diseases (e.g. diabetes, hypertension, hypercholesterolemia); 2) Normal weight population and 3) Intervention did not include diet and physical activity. 4) Did not include BMI as outcome measure 5) Only baseline data available 6) Conference abstracts.

The quality of trials was reviewed according to the 2010 CONSORT (Consolidated Standards of Reporting Trials) guidelines (CONSORT, 2017). The two authors reviewed the studies independently by screening the titles, abstracts and if suitable, full-text. The authors resolved the inclusion or exclusion discrepancies by discussion. The selected studies were independently analyzed and assessed. Disagreements regarding data extraction, analysis and assessment were resolved by discussion and consultation of a third person in case of persisting disagreement.

Data on study method, participants' information, control and interventions, outcomes and additional information were extracted from selected studies and filled in an agreed template. Data synthesis was by tabulation and exploration of relationships within and between included studies in a narrative summary. Bias were assessed based on study design, attrition rates, intervention and outcome measures, precision of results and reporting biases.

3. Results

Searches using the above keywords revealed 1037 articles. The search was narrowed down to randomized controlled trials or systematic review or meta-analysis. A total of 83 articles were found. After processing, 11 studies were included in the review. (Fig. 1) All except one study were conducted in the USA, with study periods from 2007 to 2015. There were nine clustered RCT with clusters number various ranging from 4 to 34, 1 cohort RCT and 1 RCT. Recruited subjects were workers from six work types: health, hospital, hotel, manufacturing, transport, fire service and university. The interventions applied were dietary advice and physical exercise with one study adding cognitive behavioral training and another using motivational interviewing. 7 studies used environmental interventions. Interventions lasted from nine months to two years. BMI was the primary outcome in all selected studies. The selected studies were listed as 1 to 11 and their references were from 19 to 29 according to numerical sequence and also indicated in Table 1.

3.1. Critical appraisal of studies

3.1.1. Title and abstract

Five studies (study 1, 3, 4, 10, 11) were identified as a randomized trial in the title. All studies had structured summaries of trial design, methods, results and conclusions.

3.1.2. Background, objectives and trial design

All studies mentioned background, objectives and described trial design.

3.1.3. Participants

Only study 9 did not describe eligibility criteria for participants. All studies described settings and locations of data collection. Three studies chose employees in healthcare settings (study 1, 6, 7). Study 1 included female workers only, and study 2 chose hotel workers of Asia-Pacific Island ancestry, resulting in lack of representativeness of general

working population. Two studies chose workers in metropolitan areas (study 3, 5). Two studies chose manufacturing company employees (study 4, 10). Study 8 chose transit employees and Study 11 chose university employees. Study 9 chose fire-fighters whose job nature required intense physical exertion under extreme conditions, which was not representative of the general working population. No particular study was representative of the diverse range of occupations in society. However, all studies recruited a working age (average 40–50 years old) overweight patient population (mean BMI > 25).

3.1.4. Interventions

Table 1 summarizes the interventions. Interventions lasted nine months to two years. Seven of the studies used environmental interventions only (Study 3, 4, 5, 6, 7, 8 and 11). Study 1 delivered dietary advice, physical exercise and cognitive behavioral training. Study 2 delivered an environmental intervention, dietary advice and physical exercise. Study 9 and 10 compared motivational interviewing to a team-centered curriculum and educational intervention respectively. All the studies described clearly how interventions were administered.

3.1.5. Outcomes

All of the studies had completely defined and pre-specified weight loss outcome measures. All studies used Body Mass Index (BMI) as an outcome measurement and measured BMI at baseline and on follow-up. Staff assessed BMI, rendering the assessment more objective. Only study 5 used self-reported BMI, which was strongly correlated with measured BMI.

3.1.6. Sample size

The number of participants ranged from 98 to 4236. Study 1, 3, 6, 7, 9 and 10 did sample size calculation. This is especially important in cluster randomized controlled trials: Due to the clustering effect from randomized worksites, an increased number of subjects are needed to detect the same amount of difference compared to trials involving simple random allocation of individuals.

3.1.7. Randomization: Sequence generation, allocation concealment and implementation

All studies except study 7 and 10 were cluster randomized controlled trials. Study 7 was a cohort-randomized trial consisting of one intervention worksite and one control worksite. Study 10 was a randomized control trial. The number of clusters in the cluster randomized controlled trials ranged from 4 to 34. The sequence generation process was described in most studies. Study 4 only described the method used to generate the random allocation sequence for selecting employees to participate in the study, but not the method used to randomize the worksites. Study 1 carried out stratified randomization, while study 10 used simple randomization. The remaining studies matched worksites into pairs, before randomly choosing one worksite in the pair to receive the intervention.

Study 1, 9 and 10 had allocation concealment. Only study 1, 3 and 10 described the implementation process, such as who generated the random allocation sequence, who enrolled the participants and who assigned participants to interventions.

3.1.8. Blinding

None of the studies blinded subjects to the intervention. Blinding of subjects is not feasible in lifestyle intervention studies. However, implementing an alternative intervention in the control groups, as opposed to no-contact control, may make it more difficult for subjects in control groups to guess which group they are in. Study 3, 4, 6, 8 and 11 had no-contact control groups, whereas the remaining studies had alternative interventions for control groups such as health education, health risk assessment and delayed intervention.

Only study 1 had blinding of outcome assessors. This is feasible in all studies and could decrease the chance of observer bias and increase

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