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Short Communication

Integrating mindfulness training in school health education to promote healthy behaviors in adolescents: Feasibility and preliminary effects on exercise and dietary habits

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ABSTRACT

Whether mindfulness training (MT) could improve healthy behaviors is unknown. This study sought to determine feasibility and acceptability of integrating MT into school-based health education (primary outcomes) and to explore its possible effects on healthy behaviors (exploratory outcomes). Two high schools in Massachusetts (2014–2015) were randomized to health education plus MT (HE-MT) (one session/week for 8 weeks) or to health education plus attention control (HE-AC). Dietary habits (24-h dietary recalls) and moderate-to-vigorous physical activity (MVPA/7-day recalls) were assessed at baseline, end of treatment (EOT), and 6 months thereafter. Quantile regression and linear mixed models were used, respectively, to estimate effects on MVPA and dietary outcomes adjusting for confounders. We recruited 53 9th graders (30 HEM, 23 HEAC; average age 14.5, 60% white, 59% female). Retention was 100% (EOT) and 96% (6 months); attendance was 96% (both conditions), with moderate-to-high satisfaction ratings. Among students with higher MVPA at baseline, MVPA was higher in HE-MT vs. HE-AC at both EOT (median difference = 81 min/week, $p = 0.005$) and at 6 months ($p = 0.004$). Among males, median MVPA was higher (median difference = 99 min/week) in HE-MT vs. HEAC at both EOT ($p = 0.056$) and at 6 months ($p = 0.04$). No differences were noted in dietary habits. In sum, integrating school-based MT into health education was feasible and acceptable and had promising effects on MVPA among male and more active adolescents. These findings suggest that MT may improve healthy behaviors in adolescents and deserve to be reproduced in larger, rigorous studies.

1. Introduction

Unhealthy diets and physical inactivity are modifiable risk factors for the development of cardiovascular disease, the principal cause of death in the United States and worldwide (Benjamin et al., 2017). Both behaviors have been linked with the early development of atherosclerosis (Raitakari et al., 2003) and are highly prevalent among adolescents (Benjamin et al., 2017). Since developing healthy dietary and exercise habits in youth leads to significant health benefits in adulthood, it is of primary importance to develop programs aimed at establishing such behaviors early in life (Daniels et al., 2011). Endeavors in this direction, however, have been unsuccessful and have produced only modest and transitory effects (Gonzalez-Suarez et al., 2009). Typically, adolescents underestimate the long-term consequences of unhealthy behaviors (Whalen et al., 1994) and may be reluctant to engage in preventive behaviors for which they do not see any immediate benefit.

Mindfulness training (MT), a behavioral approach aiming at the cultivation of a particular way of paying attention (on purpose and non-judgmentally) (Kabat-Zinn, 1990) to the moment-to-moment experience of mental events and physical sensations, has great potential for improving healthy behaviors by increasing the capacity for attentional and emotional self-regulation (Shapiro et al., 2006; Carmody, 2009). Evidence from observational studies suggests, in fact, that individuals who are more mindful tend to have healthier dietary and exercise behaviors (Roberts and Danoff-Burg, 2011; Gilbert and Waltz, 2010) and that MT can improve healthy behaviors in adults (Loucks et al., 2015; Salmoirago-Blotcher et al., 2013). The role of MT in promoting healthy behaviors in adolescents, however, has never been explored.

The goals of this study were to determine the feasibility and acceptability of integrating MT into school-based health education (primary outcome) and to explore its possible effect on exercise and dietary behaviors (exploratory outcomes).

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2. Materials and methods

This pilot study (Clinicaltrials.gov NCT01975896) was conducted in two high schools in central Massachusetts (2014–2015) offering health education as part of their 9th grade curriculum. To be enrolled, participants had to be 9th graders and English-speaking. They were excluded if they planned to move out of the area, were unable/unwilling to provide informed assent/consent, and had a history of psychiatric conditions or developmental delay.

To avoid contamination between interventions, schools (instead of individual students) were randomized to Health Education plus MT (HE-MT) or to Health Education plus Attention Control (HE-AC). Once student assent and parental consent were obtained and eligibility confirmed, students were enrolled in the study and followed the protocol for their school condition. Students received a $20 incentive at each assessment visit. The Institutional Review Board at the University of Massachusetts Medical School approved the study protocol (Docket H-00002904).

2.1. Interventions

Interventions were delivered during the health education period at both schools. To avoid singling out, all students received study interventions but only those who provided assent/consent completed study assessments.

2.1.1. Health education (both schools)

Students received one health education session for four days/week for two consecutive weeks delivered by health education teachers at each school. The curriculum (identical for both schools) was based on the standard health education curriculum adopted in high schools in Massachusetts integrated with materials from the Diabetes Prevention Project and the American Heart Association (AHA) (Salmoirago-Blotcher et al., n.d.) and focused on increasing the intake of healthy food and reducing that of unhealthy food, eating breakfast, portion sizes, engaging in at least 1 h of moderate-to-vigorous physical activity (MVPA) every day, and reducing sedentary behavior.

2.1.2. Mindfulness training (HE-MT school)

Students received one 45-min session of MT per week for 8 weeks, led by a certified mindfulness instructor. The curriculum was based on the widely known Mindfulness-Based Stress Reduction program, modified to meet the needs of adolescents (Prince et al., 2011). Students were trained to cultivate attention to bodily and breathing sensations, sounds, visual objects, thoughts, and emotions; to learn noticing which events the attention was spontaneously drawn to from moment to moment; and to practice mindful movement exercises (walking and standing yoga). Students also listened to a 15-min digitally recorded guided mindfulness practice in class every day during non-session days and were encouraged to listen to the recording on their own at least once daily throughout the duration of the intervention.

2.1.3. Attention control (HE-AC school)

Students received one “attention control” session/week for 8 weeks. The curriculum focused on topics such as wellness, health risk factors, mental and emotional health, self-esteem, and resiliency.

2.2. Intervention Fidelity

Mindfulness instructors digitally recorded each session and 10% of recordings were randomly audited. A checklist was used by health education teachers to ensure all planned topics were discussed (Bellg et al., 2004).

2.3. Study assessments

Assessments were performed at baseline, end of treatment (EOT) and 6-month thereafter (end of the academic year). With the exception of diet and physical activity, assessments were conducted at school using Research Electronic Data capture (REDCap) technology. Data management and analysis personnel were blinded to school allocation; the research assistant was blinded to the study outcomes.

2.3.1. Primary outcomes

Feasibility metrics included retention rates, class attendance, and intervention adherence (number of times/week participants listened to the study recording, assessed via a self-reported mindfulness log). *Acceptability* was assessed using a program satisfaction survey (ratings ranged from 1-not at all to 5-very much).

2.3.2. Exploratory outcomes

The 7 day physical activity recall (PAR), (Blair et al., 1985) conducted by trained personnel via phone interviews, was used to measure MVPA in minutes/week. Dietary measures included key components of AHA dietary recommendations such as intake of fruits and vegetables, sodium, fish, and sugar-sweetened beverages (Gidding et al., 2005) assessed via 24-h phone dietary recall (Interactive Nutrition Data System, University of Minnesota, Minneapolis, MN) conducted by trained assessors on a randomly selected day of the week.

2.3.3. Covariates

Age, gender, ethnicity, and socio-economic status were self-reported at baseline. *Body mass index* (BMI - weight (kg)/height squared (meters)) was calculated from direct measurements of weight and height; BMI percentiles for age/sex were determined using CDC growth charts. *Perceived parental control* on dietary habits, healthy food availability, and PA was assessed using a questionnaire based on the Parental Control Index (Johnson and Birch, 1994). *Depression* was measured using a validated 6-item measure of depressive mood with scores ranging from 10 to 30 (Kandel and Davies, n.d.).

2.4. Sample size

Sample size was estimated based on retention rates, a key aspect of feasibility. Based on estimates from previous studies, the design effect is $1 + (0.027 \times 1.5 \times (20 - 1) = 1.77$. For a minimum nominal per-school sample size of 23 – corresponding to an effective per-school sample size of 23/1.77 = 13 – and an anticipated 95% retention rate based on our prior studies, a conservative projected 95% confidence interval for per-condition (school) retention rate was (67.6%, 100%).

2.5. Statistical analysis

Analyses were performed according to the intention to treat approach. Retention, attendance, adherence as well as acceptability scores at EOT and 6 months of follow-up were calculated separately for each condition. For exploratory outcomes, interest was in obtaining estimates of effect rather than in hypothesis testing. As physical activity outcomes are subject to high variability, particularly in small samples, quantile regression (which models the median outcome at follow-up in lieu of the mean) was used, controlling for baseline values of MVPA and potential confounders (gender, parental control, depressive symptoms, race, and socio-economic status). One significant outlier with respect to baseline MVPA was removed from subsequent analyses. As there was substantial variability in baseline MVPA models also included interactions between group and baseline activity. Finally, we explored potential moderating effects of gender on MVPA, using a similar approach.

Linear mixed models were used to estimate effects on dietary outcome Models included random effect for class and adjusted for baseline value of the outcome and the same potential confounders as mentioned above.