Two-Year Outcomes from the NEAT Girls Obesity Prevention Cluster Randomized Controlled Trial

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ABSTRACT

Background: Obesity prevention among youth of low socio-economic position is a public health priority given the higher prevalence of youth obesity in this population sub-group.

Purpose: To evaluate the 24-month impact of a school-based obesity prevention program among adolescent girls living in low-income communities.

Methods: A school-based group randomized controlled trial that involved 12 secondary schools located in low-income communities in New South Wales, Australia. Participants were 357 adolescent girls (13.2 ± 0.5 years). The 12-month multi-component intervention was guided by Social Cognitive Theory and involved strategies to promote physical activity, reduce sedentary behaviors and improve dietary outcomes. The primary outcome was body mass index (BMI) and secondary outcomes were BMI z-score, percentage body fat (bioelectrical impedance analysis), physical activity (accelerometers), dietary intake and recreational screen-time (self-report). Data were collected in 2010-2012 and analyzed in 2012.

Results: After 24 months, the intervention effects on BMI (adjusted mean difference [95% CI] = -0.33 [-0.97 to 0.28)], $p = 0.353$) and BMI z-score (-0.12 [-0.27 to 0.04], $p = 0.178$) were not statistically significant. However, there was a significant group-by-time interaction for percentage body fat (-1.96% [-3.02 to -0.89, $p = 0.006$). Intervention effects for physical activity, screen-time and dietary intake were not statistically significant.

Conclusion: The NEAT Girls intervention did not result in significant effects on the primary outcome. Further study of youth who are 'at risk' of obesity should focus on strategies to improve retention and adherence in prevention programs.

Trial Registration: Australian New Zealand Clinical Trials Registry No:ACTRN1261000033004

BACKGROUND

Both the negative consequences of unhealthy weight gain, [1] and the high likelihood of pediatric obesity tracking from childhood to adulthood, [2] highlight the importance of targeting youth who are 'at risk' of obesity. While there is evidence to support the beneficial effects of school-based child obesity prevention interventions, few studies have assessed maintenance or sustainability of impact after the initial post-test assessments. [3] This paper presents the 24-month outcomes from the Nutrition and Enjoyable Activity for Teen Girls (NEAT Girls) intervention. NEAT Girls was a 12-month obesity prevention program targeting adolescent girls living in low-income communities. [4] After 12-months the intervention effects on body composition were not significant, but there was a significant group-by-time interaction for reduced screen-time. The aim of this paper is to report the sustained impact of the program on body composition and health behaviors.

METHODS

Study design and participants

The study design, methods and participant characteristics at baseline are reported in detail elsewhere. [5] Briefly, the NEAT Girls intervention was evaluated using a group randomized controlled trial (RCT) which included involving 12 secondary schools located in low-income communities in New South Wales, Australia. Study participants were adolescent girls in Grade 8 at the time of recruitment. Ethics approval for the study was obtained from the University of Newcastle, Australia and the New South Wales Department of Education and Training Human Research Ethics Committees. School principals, parents and study participants provided written informed consent.

The sample size calculation was based on change in body mass index (BMI). To detect a between group difference of one BMI unit, [6] 30 participants from each of the 12 schools were required. This calculation was based on an alpha of 0.05 (two tailed), power of 80% and a drop-out rate of 20%. Baseline assessments were carried out before randomization during May/June, 2010 (Figure 1). The 12-month (immediate post-program) assessments were completed during May/June in 2011 and these outcomes have been reported. [5] This paper reports the 24-month outcomes (May/June, 2012).

Intervention

The intervention was guided by Social Cognitive Theory [7] and informed by the Program X pilot study. [8, 9] NEAT Girls[4] combined a range of strategies to promote lifestyle (e.g. walking to school) and lifetime physical activity (e.g., resistance training), improve dietary intake and reduce sedentary behaviors. Intervention components included enhanced school sport sessions, lunchtime physical activity sessions, nutrition workshops, interactive educational seminars, pedometers for self-monitoring, student handbooks, parent newsletters, and text messages to reinforce and encourage targeted health behaviors.

Outcome measures

Data were collected at the study schools by trained research assistants. Group allocation to control or intervention treatment did not take place until after baseline assessments were conducted.

Body Composition

The primary outcome was BMI (weight [kg]/height [m]^2). A portable digital scale (Model no. UC-321PC, A&D Company Ltd, Tokyo Japan) and a stadiometer (Model no. PE087, Mentone Educational Centre, Australia) were used to measure weight and height and BMI-*z* scores were calculated. [10] The Imp™ SFB7 bioelectrical impedance analyzer [11] examined percentage body fat.

Physical Activity

Actigraph accelerometers (MTI models 7164, GT1M, GT3X) were used to collect physical activity data. Participants' data were included in the analyses if accelerometers were worn for ≥ 600 minutes per day for at least three days, including a weekend day. Mean counts per minute (CPM) and percentage of time in moderate-to-vigorous physical activity (MVPA) were calculated.

Dietary Intake

Dietary intake was assessed using the Australian Child and Adolescent Eating Survey (version 1.2). [12] Values for total kilojoules/day and total kilojoules/kilogram/day were reported.

Sedentary Behavior

Participants self-reported their screen-based sedentary behaviors using the Adolescent Sedentary Activity Questionnaire. [13]

Analysis

Analyses followed the intention-to-treat principle and were conducted using linear mixed models. [14] The mixed models were tested using the PROC MIXED statement in SAS V9.1 (SAS Institute Inc Cary NC) and were adjusted for clustering at the school level. All statistical tests were two-tailed and *p*-vales were adjusted for multiple computations (critical *p*-value = 0.0063).

RESULTS

The study sample included 357 (*M*=13.2 years, *SD*=0.5) girls and at baseline, 27.9% and 16.2% of the sample were overweight or obese, respectively. At the 24-month assessments, 114 (64.0%) and 123 (68.7%) girls were retained in the intervention and control groups (Figure 1). Changes in BMI were not statistically significant (Table 1), but there was a statistically significant group-by-time interaction effect for percentage body fat (-1.96%, *p*=0.006). The intervention group decreased their screen-time and both groups decreased their physical activity and total daily energy intake over the 24-month study period. There were no significant group-by-effects for any of the health behaviors.

DISCUSSION

This paper reports the sustained impact of the NEAT Girls intervention on body composition and health behaviors. After 24-months, the NEAT Girls intervention effect on the primary outcome (BMI) was not significant, but there was a significant between group difference of almost 2% body fat in favor of the intervention group. A difference of this magnitude may be considered clinically significant. Evidence from recent longitudinal [15] and experimental [16] studies have demonstrated that similar changes in body composition are associated with more favorable cholesterol and fasting insulin levels in youth, respectively.

The absence of a statistically significant intervention effect on BMI and BMI z-score, despite significant improvements in body fatness is consistent with findings from previous obesity prevention studies in adolescents, [17, 18] and highlight the challenges of accurately assessing body composition in youth. Currently, there is no consensus regarding the most appropriate measure for assessing change in obesity prevention studies. Cole and colleagues [19] suggest BMI is the best measure of adiposity change in growing youth. Yet others have argued that BMI lacks the sensitivity to distinguish between fat and fat-free mass, and that alternate measures are more suitable for detecting change in body composition (e.g. skinfolds). [17, 18]

After 24 months, there were no significant intervention effects for any of the behavioral outcomes. Although there was a significant between group difference of 30 minutes screen-time at the 12-month assessments, [5] this difference was no longer significant in the 24-month follow-up analyses. It appears that the NEAT Girls intervention had a more favorable effect on sedentary behavior than physical activity or dietary behaviors. Interestingly, these results support findings from a review of behavioral interventions to prevent obesity in youth, which indicated that strategies to reduce unhealthy behaviors seem to be more effective than strategies to increase healthy behaviors. [20]

The study strengths include the group RCT design, the unique study population and monitoring of intervention fidelity. Further, the inclusion of 24-month assessments provides evidence for the distal impact of the 12-month intervention. However, there are some limitations that should be noted, including the use of self-report measures to assess changes in screen-time and dietary behaviors, and poor accelerometer compliance. Finally, due to participant attrition, the analyses were underpowered to detect small changes in BMI. This combined with lack of measurement precision may have prevented us from detecting relatively large intervention effects in behavioral outcomes.

Conclusion

The NEAT Girls intervention resulted in statistically significant improvements in body fatness that may have clinical importance. Reductions in screen-time were also observed over the study period

which may have important implications for preventing unhealthy weight gain among adolescent girls living in low-income communities. The current findings demonstrate the potential for multi-component school-based interventions, but also highlight the need to identify strategies for retaining participants in obesity prevention interventions, especially those from disadvantaged communities which have transient populations.

ABBREVIATIONS

BMI – Body Mass Index

CI – Confidence Intervals

CPM – Counts Per Minute

CONSORT - Consolidated Standards of Reporting Trials

MVPA – Moderate-to-Vigorous Physical Activity

NEAT Girls – Nutrition and Enjoyable Activity for Teen Girls

RCT – Randomized Controlled Trial

SCT – Social Cognitive Theory

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The individuals personally identified in the acknowledgements have consented to their names being communicated.

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List of titles for all figures

Figure 1: Flow of Participants through the study