Title

Long-term outcomes following the MEND 7-13 child weight management program

Running head

Childhood obesity program: long term outcomes

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Abstract

Background: In the current study we report outcomes 2.4 years from baseline in a random subsample of overweight and obese children who attended MEND 7-13 programs delivered in UK community settings under service level conditions.

Methods: The study employed an uncontrolled pre follow-up design. 165 children were measured. Outcomes included anthropometry, parental perception of emotional distress, body esteem, and self-esteem.

Results: Overall, there were significant improvements in all outcomes apart from BMI z-score. In boys, BMI z-score, waist circumference z-score and psychometrics all improved. In girls, there were no statistically significant differences at 2.4 years, except for body esteem.

Conclusions: In real world settings, the MEND intervention when delivered by non-specialists, may result in modest yet positive long-term outcomes. Subsequent research should focus on improving the outcome effect size, providing effective behavior change maintenance strategies and further investigating the reasons behind the observed gender differences.

Keywords

Childhood obesity, weight management, community-based, long-term outcomes

Introduction

Various interventions aiming to reduce overweight in youth result in positive outcomes, however they are predominantly conducted in clinical settings and include small, homogeneous samples. Therefore, their application to the general population is questionable, despite the urgent need for scalable pragmatic approaches to reduce childhood obesity.[1, 2] Such approaches have several inherent methodological challenges (sample characteristics, study design, attrition), nevertheless their results are important and valuable for the scientific community and the population in need. MEND 7-13 (Mind, Exercise, Nutrition... Do it!) is the most widely disseminated, community-based, child weight management program in the UK and internationally; it aims to support families of overweight or obese children to adopt and sustain healthier lifestyle behaviors. Previous research has demonstrated positive effects of MEND 7-13 on a wide range of outcomes at 3, 6 and 12 months from baseline.[2, 3] In the current study we report outcomes at 2.4-years from baseline in a random subsample of children who attended MEND 7-13 programs delivered in London (UK) community settings under service level conditions (i.e. not for research, but following the provision of the MEND 7-13 program as a child weight management public health service).

Methods

Intervention

The MEND 7-13 program is a scalable intervention designed to address diet and physical activity through education, skills training, and motivational

enhancement. Children are eligible if they are aged between 7-13 years and they are overweight or obese (BMI ≥ 91st centile).[4] The 10-week, twice-weekly intervention was delivered to groups of children and their accompanying parent/carer in community settings by non-specialists and by a wide variety of partner organizations. MEND 7-13 was provided free of charge to families. The cost per family for the funding organizations varied by several factors such as project size, number of children and available local resources.[5] Intervention content and training was provided following standardized procedures.[3]

Study Design

The current trial was undertaken as a separate study (i.e. it was not part of the standard MEND 7-13 child weight management service) and employed an uncontrolled pre follow-up (2.4 years) design. Of the 53 MEND 7-13 programs conducted in London, UK between January-October 2009, half were randomly selected for inclusion in this study. Randomization was carried out retrospectively (i.e. 2.4 years after the intervention) by an independent researcher at University College London Institute of Child Health using Stata version 12.1 software. Of the 423 eligible participants, 286 (68%) had valid contact details in 2011 and were invited to participate in the study between July-November 2011. Of those, 165 children were measured at 2.4 years (range 1.8 to 2.8) from baseline. Parents gave informed written consent for their child to participate in the MEND 7-13 program and for their data to be used after anonymization.

Baseline measurements were part of MEND 7-13 standardized assessment; more precisely, they were taken during the first session by the team running the program at each site. Follow-up measurements were conducted at public venues including leisure centres and schools. Participants and their parents were invited to attend a local measurement session. Those unable to attend the measurement session were visited at their home. A questionnaire pack containing the psychometric measures was sent to all participants in advance. Height, weight, and waist circumference were measured by the research team during measurement sessions and home visits.

Outcomes

Anthropometry

Body weight (kg) and height (m) were measured using standardized procedures on a digital scale and a floor standing Leicester stadiometer.[6] Body mass index was calculated as body weight (kg)/height^2 (m^2). Waist circumference was measured 4 cm above the umbilicus.[7] BMI and waist circumference z-scores were calculated from UK national reference data.[4, 8]

Psychological indices

As psychological status is often affected in overweight and obese children,[9] the following tools were used to explore the effect of the intervention on children's psychological well-being:

The strengths and difficulties questionnaire was used to assess parental perception of emotional distress.[10]

Body esteem was assessed using Mendelson's body esteem scale, a children's questionnaire that measures the way a child thinks and feels about the appearance of their body.[11]

Self-esteem was assessed using Rosenberg's self-esteem scale, a children's questionnaire which evaluates the general attitude a child has about themselves.[12]

Demographics

Demographic information was collected as outlined in the UK National Obesity Observatory Standard Evaluation Framework for weight management interventions.[13]

Statistical analysis

Baseline differences by gender and by randomization group were examined using independent sample t-tests for continuous variables and chi square for categorical variables. Differences in outcomes at 2.4 years were investigated using paired t-tests. All analyses were conducted using SPSS 22.0 for Windows (SPSS, Chicago, IL).

Results

There were no differences between randomization groups for any of the baseline variables, apart from age and height, which were still very small (non randomized children were 0.3 years younger and 2 cm shorter than their randomized counterparts). Data from 165 overweight or obese MEND participants were used in the current analysis (Table 1). Mean age at baseline was 10.3 years (± 1.8), 53% of participants were male and 90% were obese (> 98th BMI centile).[4] Sociodemographic data revealed that 37% of children were white, 36% belonged to single parent families, 31% of parents were unemployed, and 48% of families did not own their accommodation. Sociodemographic data did not differ by gender. Compared to the MEND eligible population as defined using data from the Health Survey for England,[2] the current population had similar percentage of males (53% vs 53.8%) and single parent families (36% vs 30.5%), higher percentages of obese participants (90% vs 46.2%) and families who were renting their accommodation (48% vs 36.5%) and lower percentages of white participants (37% vs 79.6%). There were no baseline differences between those who were measured at follow-up and those who were not, with the exception of accommodation type (those who owned their accommodation were more likely to be measured at follow-up). Follow-up results by gender and in the total sample are presented in Table 2. Overall, there were significant improvements in all outcomes apart from BMI z-score. In boys, BMI z-score, waist circumference z-score and psychometrics all improved. In girls, there were no statistically significant differences at 2.4 years, except for body esteem.

Discussion

The current study aimed to shed some light on the challenging research area of obtaining long term outcomes following real-world childhood obesity interventions. The limitations of such efforts are well known and described in detail below. However, disseminating such results is highly important, as it underlines the need for good quality data and provides the research community with a platform to develop more effective ways of developing and monitoring pragmatic approaches against childhood obesity.

In comparison to the MEND-eligible population, proportionally more children in the current sample were obese, non-white and lived in less favourable socio-economic circumstances (indicated by family structure and housing tenure).[2] The present study revealed that participants who were followed up more than 2 years after MEND 7-13, experienced positive outcomes in anthropometry and psychological indices such as children's emotional distress, body esteem, and self-esteem, and positive outcomes were more pronounced among boys (Table 2).

Literature in the field of community-based childhood obesity management, especially with regard to real-world approaches and long-term outcomes is still very limited. Furthermore, variability in intervention duration, intensity, content, and maintenance strategies make direct comparisons between studies difficult. Notwithstanding these limitations, the BMI z-score reduction we observed for boys is similar to the majority of childhood obesity interventions run under service level conditions.[15, 16] Greater reductions in BMI z-score at 2 years have been reported by one UK community intervention, but this was a small pilot study with 23 participants.[17]

Studies that are hospital-based and recruit severely obese participants, or those conducted under strict research conditions, often report greater BMI z-score reductions.[18-20] However, these interventions are methodologically and operationally different, since they are delivered by specialists and are addressed to a small proportion of the obese pediatric population. Whether the results of such approaches are generalizable and replicable is largely unknown. Also, their ability to be delivered on a population level in order to significantly impact the current prevalence of childhood obesity remains unexplored.

It should be mentioned that the gender differences we observed are not in accordance with available literature. This discrepancy may be attributed to the greater decline in physical activity levels –especially vigorous intensity physical activity- among participating girls.[21] This may have resulted in greater BMI z-score relapse to baseline levels, which, in turn, may have been exacerbated by the relatively earlier sexual maturation of girls compared to boys, especially those with increased adiposity.[22] However, the observed BMI z-score maintenance among girls can still be considered a positive outcome; evidence indicates a tendency for overweight children to become obese during adolescence,[23] and for obese children and adolescents to demonstrate greater adiposity in early adulthood.[24] Thus, without intervention, the adiposity and BMI z-score of children in the current study may have continued to deteriorate.

To date, there is no established BMI z-score change associated with clinically significant health benefits,[25] although according to some experts any BMI z-score reduction is positive.[26] Therefore, the modest results observed in the current study can be viewed as beneficial since they may reflect long-term,

realistic outcomes that can be extrapolated to the wider overweight and obese pediatric population.

Modest weight loss has been associated with psychosocial and other health benefits such as improved perceived physical ability, quality of life and self-esteem,[15, 16, 27] which is supported by the improvements in boy's psychological scores (Table 2).

The statistically significant short to medium term improvements on measures of self-esteem and parent-rated symptoms of psychological distress previously reported in girls[2, 14] were not maintained at longer-term follow-up. However, this is not particularly worrying since measures for scores at all time points fell below the threshold for clinical significance in both boys and girls. The exception to this was the body esteem scores which were statistically improved at 2.4 years. This suggests that participation in the intervention was associated with a lasting positive impact upon the way children thought and felt about their bodies. Obesity is a major risk factor for the later development of eating disorders and body dissatisfaction can contribute to that. Therefore, the finding of a sustainable improvement in body image may suggest that the intervention had a lasting impact on an aspect of psychological functioning that has been causally implicated in the pathway linking obesity and the development of eating disorders.[28-30]

Limitations of this study include the fact that puberty was not assessed, data were uncontrolled and study attrition was 42%. This attrition rate is not atypical for reports of service-level implementation,[15-17] but may be a source of bias that could lead to an overestimation of treatment effect. Further, it is important to remember that participants in studies of this nature are by default treatment

seeking families that may be inherently different to the general population. Also, the intervention duration was 10 weeks, and the follow-up time period 2.4 years; due to the long time gap, one cannot assume that the observed results are solely attributed to the intervention. Last, support offered to families after the 10-week programme varied by site, but this information was not available.

Conclusion

The current study suggests that the MEND 7-13 intervention when delivered at scale in a real world setting, by non-specialists, may result in modest yet positive long-term outcomes. Subsequent research should focus on developing additional strategies to enhance behaviour change maintenance in order to improve the effect size as well as further investigate the causes leading to the observed gender differences.

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Disclosure statement

All authors were employed at MEND Central Ltd during the study period. Maria Kolotourou and Paul Sacher are consultants at Mytime Active, the charity and social enterprise that currently owns MEND.

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Table 1: Baseline characteristics

	Overall		Boys		Girls	
Variable	**n**	**Mean ± SD**	**n**	**Mean ± SD**	**n**	**Mean ± SD**
Age (years)	165	10.3 ± 1.8	87	10.4 ± 1.7	78	10.2 ± 1.9
Weight (kg)	165	57.8 ± 15.1	87	58.3 ± 13.3	78	57.1 ± 17
Height (m)	165	1.46 ± 0.11	87	1.47 ± 0.1	78	1.4 ± 0.1
BMI (kg/m²)	165	26.8 ± 4.4	87	26.5 ± 3.7	78	27 ± 5
BMI z-score	165	2.72 ± 0.59	87	2.8 ± 0.58	78	2.6 ± 0.6
Waist circumference (cm)	159	85.6 ± 10.6	85	86.8 ± 10.7	74	84.2 ± 10.5
Waist circumference z-score	159	3.08 ± 0.62	85	3.04 ± 0.66	74	3.1 ± 0.6
Total difficulties score (0-40)	146	12 ± 5.9	77	12.4 ± 5.8	69	11.6 ± 6
Body esteem (0-24)	139	10 ± 5.6	75	9.9 ± 5.4	64	10.1 ± 5.7
Self-esteem (0-30)	139	17.9 ± 6.3	75	18.3 ± 6.1	64	17.4 ± 6.6

BMI: Body mass index, SD: Standard deviation
Numbers differ between variables due to data cleaning and/or missing data
There were no between gender differences, as obtained by independent sample t-test.

Table 2: Within-subject changes in outcome variables 2.4 years from baseline

	Overall (n = 123 - 153)			Boys (n = 68 - 83)			Girls (n = 53 - 70)		
	Baseline Mean ± SD	2.4 years Mean ± SD	Mean change (CI)	Baseline Mean ± SD	2.4 years Mean ± SD	Mean change (CI)	Baseline Mean ± SD	2.4 years Mean ± SD	Mean change (CI)
BMI z-score	2.70 ± 0.60	2.63 ± 0.73	-0.07 (-0.13 to 0.003)	2.79 ± 0.58	2.61 ± 0.72	-0.17 (-0.27 to -0.08)**	2.59 ± 0.60	2.65 ± 0.75	0.06 (-0.02 to 0.15)
Waist circumference z-score	3.07 ± 0.61	2.89 ± 0.82	-0.18 (-0.28 to -0.08)**	3.03 ± 0.65	2.63 ± 0.72	-0.4 (-0.52 to -0.28)***	3.11 ± 0.56	3.19 ± 0.84	0.08 (-0.06 to 0.22)
Total difficulties score (0-40)	11.9 ± 5.9	10.1 ± 5.5	-1.8 (-2.8 to -0.8)***	12.3 ± 5.9	9.9 ± 5.2	-2.4 (-3.7 to -1.1)**	11.5 ± 5.9	10.3 ± 5.9	-1.1 (-2.5 to 0.3)
Body esteem score (0-24)	10.1 ± 5.6	12.7 ± 5.7	2.5 (1.4 to 3.6)***	10.1 ± 5.5	13.2 ± 5.7	3.1 (1.6 to 4.6)***	10.3 ± 5.7	12.1 ± 5.8	1.8 (0.1 to 3.6)*
Self-esteem score (0-30)	17.8 ± 6.3	19.9 ± 6.5	2 (0.9 to 3.2)**	18.1 ± 6.0	20.8 ± 5.9	2.7 (1.2 to 4.2)***	17.5 ± 6.6	18.7 ± 6.9	1.3 (-0.5 to 3.1)

BMI: Body mass index, SD: Standard deviation
Numbers differ between variables due to data cleaning and/or missing data
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, as obtained by paired t-test.