

Systematic review on effectiveness of interventional programmes in treating childhood obesity

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Abstract

Background: The prevalence of childhood obesity is alarming and studies have shown that overweight and obese children carry more risk of developing a range of related health problems when they become older. The aim of this systematic review was to evaluate the effectiveness of childhood obesity intervention programmes.

Methods: Systematic review of published literature from 2008 to 2015. Articles were excluded if they were published before 2008, if they were not published in English; if they had incomplete statistical data; and if the participants did not belong to the age category of 6 to 12 years. All eligible articles were independently reviewed by two reviewers to assess study quality.

Results: Ten studies met the inclusion criteria. Most were conducted in a health care setting (n = 5) or school-based setting (n = 4), including one in a rural area. Half of the articles were published in 2013 and all studies had an almost equal gender distribution. All studies sought reduction in anthropometric/ body composition as their main outcomes. Only three studies were rated as strong in quality while the others were moderate.

Conclusions: Most of the interventional studies included in our review showed a significant improvement for obese children. Four out of 11 studies showed that physical activity and diet had a great impact on child obesity, while other studies showed that a hospital-care setting or school-based setting and parental involvement were more beneficial in treating obesity.

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Introduction

Globally, nearly 22 million children under 5 years of age were overweight in 2013 [1]. Numerous studies demonstrate that overweight and obese children have an 80% chance of becoming obese adults; however, this can be avoided if they reach and maintain a healthier body weight. Moreover, studies revealed that children who are obese or overweight are more at risk of developing a range of related health problems when they become older [2]. It is increasingly important,

therefore, that we act to seek to improve the health and well-being of our young generation.

Childhood obesity has started to be an issue in Asian countries; according to the National Health Morbidity Survey (NHMS) carried out in Malaysia in 2011, which reported a prevalence rate of obesity among children aged less than 18 years old of 6.1% [3]. Meanwhile, the Malaysia Global School-based Student Health Survey (GSHS) 2012 reported a higher prevalence rate of 7.9%, which is much higher compared to the prevalence reported for Indonesia

(1.3%, GSHS in 2007) and the Philippines (2.8%, GSHS in 2011) [4-6].

It is important to treat obesity as early as possible to prevent future health complications, as studies have shown that obese children tend to have metabolic (dyslipidaemia, glucose intolerance, hypertension) or mechanical consequences (obstructive sleep apnoea, orthopaedic disorders) [7].

The aim of this systematic review was to identify the effectiveness of childhood obesity interventional programmes in treating childhood obesity.

Methods

This systematic review was conducted and reported in accordance with Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) guidelines [8]. The flow diagram for the identification of relevant studies is shown in Figure 1. First, PubMed and the Cochrane Library were searched by analysis of keywords contained in the title and abstract. The following search terms were used: (1) childhood, child; (2) obesity, weight, overweight; and (3) clinical trial, intervention. This review focuses on studies published in the English language from 2008 to the end of 2015. This review was restricted to literature published during this period to focus on recent studies with the greatest potential implications for childhood interventions programs.

Childhood obesity is defined as a body mass index (BMI) at or above the 95th percentile for children and teens of the same age and sex, and overweight is defined as a BMI at or above the 85th percentile [9]. Other definitions also include a BMI Z-score of more than 2 [10].

Inclusion/exclusion criteria

Prior to this review, a standard protocol was developed for study selection and data abstraction. Study selection for this review were: 1) randomized controlled trial and must have a comparable group; 2) target population for intervention: children aged 6-12 years old only, which includes both sexes; 3) reported at least one outcome pertaining to childhood intervention programs (anthropometric, diet, physical

activity, or sedentary behaviour outcomes). Articles were excluded if 1) statistic data were incomplete or not reported; 2) a literature review 3) or a qualitative study; 4) the respondents were over 12 years of age or had undergone surgery; or 5) if obesity was due to pharmacotherapy or a congenital disorder.

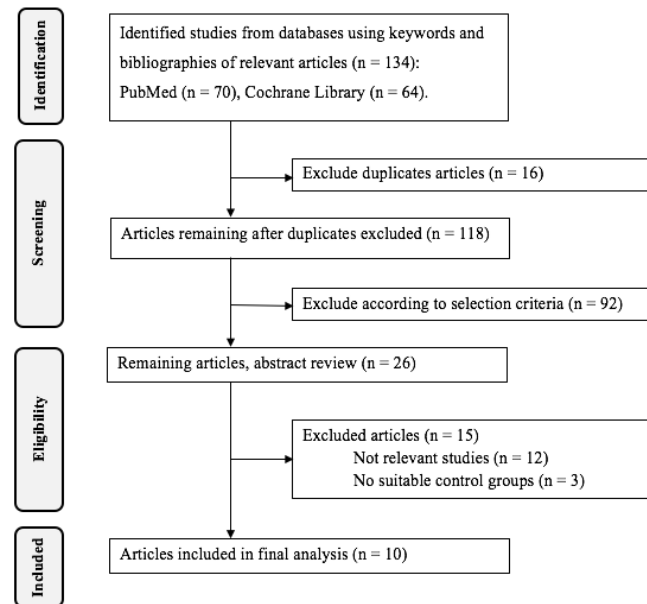


Figure 1. Flow diagram of selection process for identification of relevant articles

Study selection and data extraction

The titles and abstracts identified using the search criteria were screened by one reviewer and articles that did not meet the inclusion criteria were excluded. Twenty-six articles met the inclusion criteria. Two reviewers were assigned for a full assessment, in which both reviewers extracted the data independently. Each reviewer extracted data from the articles using a standardised form. For each article, the following data were extracted where available: leading author, year published, target group, study setting/location, sample size, participant's age and sex, description of intervention (grouping, duration, and follow up), and the study's outcomes.

Quality of reporting

The consistency and quality of each of the ten articles were checked based on the Quality Assessment Tool for Quantitative Studies developed by the Effective Public Health Practice Project, Canada [11]. The tool consists of a list of items that are recommended to assess RCTs to facilitate critical appraisal and interpretation of trials. This tool has a six-component rating scale which assesses selection bias, study design, confounders, blinding, data collection methods, and withdrawals and dropouts. Then, a rating of weak, moderate or strong is given for each component. Finally, a global rating is given: weak (two or more weak components rated as weak), moderate (less than four strong ratings and one weak rating), or strong (four strong ratings with no weak ratings). For each article, both reviewers independently assessed the study quality according to the tool. If there were any discrepancies in component ratings, a mutual consensus approach was used to resolve the discrepancies.

Results

Study selection

A total of 134 articles were identified through the database search strategy for the review process in which 16 articles were excluded as duplicate reports. The selection process (Figure 1) resulted in 26 articles eligible for this review, of which 12 articles were excluded because they were not relevant and 3 articles were removed as they had no suitable control group. Thus, 10 articles were eligible for full review, seven from PubMed and three from Cochrane Library.

Study characteristics

The baseline characteristics of studies are summarized in Table 1. Most of the studies were carried out in the United States of America [12-17], two in the Netherlands [13, 14], and one each in Spain [15] and Norway [10]. Of the 10 articles, five were published in 2013 [10, 14-17] and the remainder were published in 2008 to 2012.

Target group

Apart from the targeted overweight or obese children, four studies also recruited parental involvement [10, 12, 14, 15], three studies specifically targeted overweight and obese children [16, 19, 20], and two studies involved children recruited from all body mass index categories [13, 18].

Study setting/location

A health care setting was the most popular location for interventions [10, 12, 14, 19]; four studies carried out the intervention in a school-based setting [13, 15, 16, 18], while one study chose both a health care and home-based setting to conduct their study [20]; only one study did the intervention in a community-based setting [17].

Sample size, sex distribution, and age of participants

On average, all of the studies had an equal sex distribution except for two studies [14, 19]. However, one study did not report on the sex distribution of the participants [17]. In terms of sample size, six studies had less than a hundred participants [10, 12, 14-16] while two studies had more than a thousand participants [12, 17]. The target age for the majority of studies was 6-12 years old.

Intervention vs Control Group description

Eight of the studies had two groups, an intervention group and a control group [10, 13-19], but two studies had three groups [12, 20].

Study duration and follow-up

The shortest study duration was 8 weeks [15, 16]. Most of the studies conducted an intervention between 3 and 9 months [10, 12, 14, 19, 20], but three studies carried out interventions of more than 2 years [13, 17, 18]. The mean study duration was 12.25 ± 11.46 . In terms of follow-up, seven studies had a follow-up duration of less than 1 year [10, 13-15, 16, 19, 20].

Table 1. Summary of studies: focus, study setting/location, sample size, intervention description, and the outcome (ordered by year of publication)

First Author, Year	Country	Target group	Study setting/location*	Sample size (% male)	Age (mean ± SD)	Intervention vs Control Group description	Intervention duration	Follow-up	Outcome‡
Janicke DM, 2008	USA	Overweight or obese children (BMI ≥ 85th percentile) and their parent	HBS: in rural area	71 (40% male)	Behavioral family-based intervention : 11.4; vs Behavioral parent-only intervention : 11.0; vs wait-list control group : 11.0	3 groups: Behavioral family-based intervention (n = 24) vs Behavioral parent-only intervention (n = 26), vs wait-list control group (n = 21)	4 months	10 months	No benefit
Dzewaltowski DA, 2010	USA	Students at selected schools	SBS: 7 schools	246 (50% male)	Physical activity + nutrition : 9.21 ± 0.66; vs Control groups : 9.37 ± 0.63	2 groups: Physical activity + nutrition (4 schools, n = 112) vs Control groups (3 schools, n = 134)	3 years	3 years	PA
Jansen W, 2011	Netherlands	Grade 3-8 students at selected schools	SBS: 20 schools	2622 (50% male)	6-12 years	2 groups : Physical activity (10 schools , n = 1240) vs Control (10 schools, n = 1382)	2 years	2 years	BMI WC
De Niet J, 2012	Netherlands	Overweight and obese children	HCS	141 (36% male)	9.9 ± 1.3	2 groups: SMS Maintenance Treatment (SMSMT) (n = 73) vs Control group receiving no SMSMT (n = 68)	38 weeks	12 months	Unclear

Lisón JF, 2012	Spain	Overweight or obese (BMI \geq 85th percentile)	Mixed setting : HCS and HBS	110 (51% male)	Hospital clinic group : 12.3 ± 1.9 ; vs Home-based combined exercise-diet program : 11.9 ± 2.2 ; vs Control group : 11.2 ± 2.1	3 groups: Hospital clinic group (n= 45) vs Home-based combined exercise-diet program (n= 41) vs Control group (n= 24)	6 months	6 months	Z score WC Fat
Boutelle KN, 2013	USA	Overweight or obese children, and their parents	HCS : Paediatrics clinic	50 (38% male)	Guided self-help: 10.3 ± 1.3 vs Delayed treatment control: 10.5 ± 1.4	2 groups : Guided self-help (n = 25) vs Delayed treatment control (n = 25)	5 month	11 month	Overweight % BMI Z score
Dalton III WT, 2013	USA	Overweight or obese (BMI \geq 85th percentile), and their caregivers	SBS	67 (58% male)	8.96 ± 1.98	2 groups: Weight control intervention (n = 28) vs Control group (n = 39)	8 weeks	12 months	No effect
Davis AM, 2013	USA	Overweight or obese (BMI \geq 85th percentile) recruited	SBS : rural school	58 (71% male)	8.55 ± 1.74	2 groups: Telemedicine (n =31) vs Physician visit (n =27)	8 weeks	6 months	Unclear
Economos CD, 2013	USA	Year 1 students at selected elementary school	CBS	1028 (NA)	$7.61 + 1.04$	2 groups: Physical activity + Diet (10 schools, n = 335) vs Control (20 schools, n = 693)	2 years	2 years	Weight Z score

Hystad HT, 2013	Norway	Overweight or obese children (BMI Z-scores \geq 2), and at least one parent	HCS: Paediatrics Obesity clinic	83 (47% male)	10.2 \pm 1.7	2 groups: Therapist-led group (n= 39) vs Self-help group (n = 44)	6 months	2 years	Z score Fat
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Study setting/ location*: HCS = Healthcare setting; SBS = School-based setting; CBS = Community-based setting, and HBS = Home-base setting

Outcome†: BMI = body mass index, Z score= BMI-Z-score, Fat = Fat percentage, WC = Weight circumference

Study outcomes

The main study outcomes of the 10 articles can be classified into four main components: anthropometric/body composition, behavioural changes (dietary improvement and changes in physical activity status), improvements in psychosocial well-being, and changes in metabolic indicators (Table 2). Of the 10 studies, three studies focused on a combination of anthropometric/body composition and behavioural changes [13, 14, 17], while three sought to improve diet and changes in anthropometric/body composition [10, 12, 20], and one focused on physical activity status [18].

Synthesis of significant outcomes

The outcome measures significantly affected by the intervention during the first follow-up period are indicated in Table 2. Seven studies reported a statistically significant (between-group) effect at the first post-intervention follow-up for at least one of their focus outcomes [10, 13, 14, 17, 18, 20]. None of the studies reported significant psychosocial changes.

Quality of reporting

The quality of each article varied considerably. Only two studies were classified with an overall rating of strong quality as they scored more than three strong ratings, as described in Table 3 [14, 18] while the remaining studies were classified as moderate.

Most of the studies described the withdrawals and dropouts in detail except for one study [15]. Nine

studies failed to report on the blinding of participants and the assessors; only one study described the blinding of participants in detail [15].

Discussion

There are many components that can affect intervention and effectiveness. This review revealed that all four studies that conducted interventions in a health care setting had a beneficial study outcome [10, 13, 14, 19]. All of the studies were conducted in a specialist clinic that focused on childhood obesity prevention, which obviously aided in making the intervention fruitful. Despite the variety in sample populations, study duration, and outcome measures, two studies reported effective interventions resulting in changes in anthropometric/body composition [10, 14].

In addition, this review identified four studies that used school as their place of intervention [13, 15, 16, 18]. Of these, the longest study duration was two and three years [13, 18]. Both of these studies resulted in positive outcomes and also involved teachers at the selected schools.

Moreover, all of the selected schools were proactive and gave full commitment to ensure the interventions ran successfully. These studies demonstrate that school can be the best place to start an intervention for childhood obesity prevention. The role of schools in promoting a healthy diet and physical activity among children needs to be address. Children spent most of their time in a school environment and can easily be influenced by unhealthy behaviour.

Table 2. Post-intervention outcome measures by study (ordered by year of publication)

First author, Year	Anthropometric/body composition						Metabolic						Behavioural			Psychosocial				
	Weight	% overweight	BMI	BMI Z-score	Body fat % (by BIA)	Waist circumference	Blood pressure	Fasting glucose	Fasting insulin	Total cholesterol	LDL cholesterol	HDL cholesterol	Triglyceride	Dietary intake	Physical activity	Sedentary behaviour	Other	QOL/wellbeing	Body image/ self-esteem	Other
Janicke DM, 2008																				
Dzewaltowski DA, 2010															✓					
Jansen W, 2011			✓			✓														
De Niet J, 2012																				
Lisón JF, 2012				✓	✓	✓														
Boutelle KN, 2013		✓	✓	✓																
Dalton III WT, 2013																				
Davis AM, 2013																				
Economos CD, 2013		✓		✓																
Hystad HT, 2013				✓	✓															

Shaded squares indicate those outcomes for which post-intervention data were reported.
 ✓ Indicates a statistically significant (between-group) effect for that outcome at the first post-intervention follow-up.
 BMI = body mass index; HDL = high-density lipoprotein; LDL = low-density lipoprotein; and QOL = quality of life.

The importance of parental involvement towards tackling childhood obesity was also highlighted by this review. Most studies involved exclusively overweight/obese children but 4 studies also included parental involvements [10, 13-15] of which three had positive outcomes. Since dietary behaviour is linked to energy intake and risk of obesity, parental involvement is crucial in diminishing the risk of obesity. Children’s diet is particularly influenced by their parents’ dietary habits, thus by involving parents in the intervention, the parents held the responsibility while also having the opportunity to make healthy food accessible for their children in the home [21]. Ultimately, this review

revealed that parental involvement can boost the intervention program’s effectiveness. One systematic review that examined the parental role in obesity prevention reported that direct methods of parental involvement were more likely to result in beneficial outcomes [21].

This review revealed that all the studies’ focus outcome related to anthropometric/body composition – which is mainly reduction in BMI, BMI Z-score and waist circumference. These three indicators were the best methods to determine obesity and can be derived from simple measurements. However, the studies interested in behavioural and psychosocial changes

had the most negative findings. This is because the measurements were based on participant recall. In contrast, the anthropometric/body composition and metabolic measurements provide solid evidence as the measurements do not rely on the participants.

With regards to the study quality, most of the ten articles did not describe details of blinding, which ultimately affected their study quality. Blinding is essential in controlled trial as it can prevent

performance and ascertainment bias. For example, assessors who are blind to the intervention or control status of participants are less biased than other assessors that are aware of the status of the participants. Similarly, the methods of randomisation of the participants can affect selection bias. This is because randomisation allows participants to have an equal chance of being allocated in either the intervention or control group, and can also facilitate the blinding process [22].

Table 3. Quality of reporting of the ten studies (ordered by year of publication)

First author, Year	Selection Bias	Study design	Confounding	Blinding	Data Collection Methods	Withdrawals and dropouts	Overall rating
Janicke DM, 2008	Moderate	Moderate	Strong	Weak	Strong	Strong	2
Dzewaltowski DA, 2010	Moderate	Strong	Strong	Moderate	Moderate	Strong	2
Jansen W, 2011	Strong	Strong	Moderate	Moderate	Strong	Strong	1
De Niet J, 2012	Moderate	Moderate	Moderate	Weak	Strong	Strong	2
Lisón JF, 2012	Strong	Strong	Moderate	Weak	Moderate	Strong	2
Boutelle KN, 2013	Strong	Strong	Moderate	Moderate	Strong	Strong	1
Dalton III WT, 2013	Moderate	Strong	Moderate	Strong	Moderate	Moderate	2
Davis AM, 2013	Weak	Moderate	Strong	Moderate	Moderate	Strong	2
Economos CD, 2013	Weak	Moderate	Strong	Moderate	Strong	Strong	2
Hystad HT, 2013	Strong	Strong	Moderate	Weak	Moderate	Strong	2

Study quality was assessed by a six-component rating scale described in the Methodology section. Studies were given a global rating: 1, strong; 2, moderate; 3, weak.

Conclusions

Most of the interventional studies included in this review showed a significant improvement for obese children. Four out of the 10 studies showed that physical activity and diet had a great impact on child obesity, while other studies showed that a hospital-care or school- base setting, as well as parental involvement was more beneficial in treating obesity. Childhood obesity intervention programmes are still a controversial issue in terms of their effectiveness in preventing and treating obesity among children.

References

1. World Health Organization [Internet]. Obesity and overweight: Fact sheet. 2013. [cited 2015 Dec 20]. Available from: <http://www.who.int/mediacentre/factsheets/fs311/en>
2. Engeland A, Tone B; Tverdal A, Sogaard AJ, Anne Johanne. Obesity in Adolescence and Adulthood and the Risk of Adult Mortality. *Epidemiology* 2004;15: 9-85.
3. Institute for Public Health, Malaysia. National Health Morbidity Survey 2011; 2012.
4. National Epidemiology Centre [Internet]. Philippines Global School-based Student Health Survey (GSHS) 2011. Department of Health Philippines; 2012 [cited 2013 May 10]. Available from: <http://www.who.int/chp/gshs/2004%20GSHS%20PHL%20Final%20Report.pdf>

5. National Institute of Health Research and Development [Internet]. Indonesia Global School-based Student Health Survey (GSHS) 2007. Ministry of Health, Republic of Indonesia; 2007 [cited 2013 May 10]. Available from: http://www.who.int/chp/gshs/GSHS_Country_Report_Indonesia_2007.pdf
6. Institute for Public Health, 2013. Malaysia Global School-Based Health Survey; 2012.
7. Lee YS. Consequences of Childhood Obesity. *Ann Ac Med Singapore*. 2009;38:75-81.
8. Moher D, Liberati A, Tetzlaff J. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Ann Intern Med*. 2009;151:264-9.
9. Centers for Disease Control and Prevention [Internet]. Defining Childhood Obesity; 2015 [cited 2016 May 12]. Available from: <http://www.cdc.gov/obesity/childhood/defining.html>
10. Hystad HT, Steinsbekk S, Ødegård R, Wichstrøm L, Gudbrandsen OA. A randomised study on the effectiveness of therapist-led v. self-help parental intervention for treating childhood obesity. *Br J Nut*. 2013;110:1143-50.
11. National Collaborating Centre for Methods and Tools [Internet]. Quality Assessment Tool for Quantitative Studies; 2008. Hamilton, ON: McMaster University [cited 2016 May 12]. Retrieved from <http://www.nccmt.ca/resources/search/14>
12. Janicke DM, Sallinen BJ, Perri MG, Lutes LD, Huerta M, Silverstein JH, et al. Comparison of parent-only vs family-based interventions for overweight children in underserved rural settings: outcomes from project STORY. *Arch Pediatr Adolesc Med*. 2008;162:1119-25.
13. Dziewaltowski DA, Rosenkranz RR, Geller KS, Coleman KJ, Welk GJ, Hastmann TJ, et al. HOP'N after-school project: an obesity prevention randomized controlled trial. *Int J Behav Nutr Phys Act*. 2010;7:90.
14. Boutelle KN, Norman GJ, Rock CL, Rhee KE, Crow SJ. Guided self-help for the treatment of pediatric obesity. *Pediatrics*. 2013;131:e1435-42.
15. Dalton III WT, Schetzina KE, McBee MT, Maphis L, Fulton-Robinson H, Ho AL, et al. Parent Report of Child's Health-Related Quality of Life after a Primary-Care-Based Weight Management Program. *Child Obes*. 2013;9:501-8.
16. Davis AM, Sampilo M, Gallagher KS, Landrum Y, Malone B. Treating rural pediatric obesity through telemedicine: Outcomes from a small randomized controlled trial. *J Pediatr Psychol*. 2013; 38:932-43.
17. Economos CD, Hyatt RR, Must A, Goldberg JP, Kuder J, Naumova EN, et al. Shape Up Somerville two-year results: a community-based environmental change intervention sustains weight reduction in children. *Prev Med*. 2013;57:322-7.
18. Jansen W, Borsboom G, Meima A, Zwanenburg E, Mackenbach JP, Raat H, et al. Effectiveness of a primary school-based intervention to reduce overweight. *Int J Pediatr Obes*. 2011;6(2-2):e70-7.
19. De Niet J, Timman R, Bauer S, van den Akker E, de Klerk C, Kordy H, et al. Short message service reduces dropout in childhood obesity treatment: A randomized controlled trial. *Health Psychol*. 2012;31:797.
20. Lisón JF, Real-Montes JM, Torró I, Arguisuelas MD, Álvarez-Pitti J, Martínez-Gramage J, et al. Exercise intervention in childhood obesity: a randomized controlled trial comparing hospital-versus home-based groups. *Acad Paediatr*. 2012;12:319-25.
21. Hingle MD, O'Connor TM, Dave JM, Baranowski T. Parental involvement in interventions to improve child dietary intake: a systematic review. *Prev Med*. 2010;51:103-11.
22. Moher D, Hopewell S, Schulz KF, Montori V, Gøtzsche PC, Devereaux PJ, et al. CONSORT 2010 explanation and elaboration: updated guidelines for reporting parallel group randomised trials. *J Clin Epidemiol*. 2010;63:e1-37.