Obesity Prevention

The impact of school-based prevention of overweight on psychosocial well-being of children

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Summary

This review aimed to gain insight in the extent to which psychosocial effects of obesity prevention programmes have been studied, to give an overview of the methods used to measure the particular psychosocial aspects and – if possible – to quantify the effects found. Intervention studies ($n = 267$) covering the period 1990–October 2005 were derived from seven reviews about childhood obesity interventions. An additional search identified 2754 studies covering the period January 2005–February 2008. In total, 2901 papers (excluding 120 duplicates) were screened for inclusion. Sixty-nine papers covering 53 interventions were included and screened on measuring psychosocial variables. All original authors were contacted. Seven of the selected interventions measured psychosocial variables, five of which evaluated a net intervention effect as compared with a control condition. Only two interventions reported a statistically significant net intervention effect (a decrease in use of purging or diet pills and a decrease in peer ratings of aggression and observed verbal aggression). We conclude that a minority of childhood obesity interventions investigate the effects of their programmes on psychosocial well-being of children and adolescents. It is recommended that in the future, these programmes will be evaluated in a uniform way on a broad range of psychosocial aspects

Keywords: Children, overweight, psychosocial well-being, review.

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Introduction

Prevalence of childhood and adolescent overweight and obesity has been steadily increasing over the past 20 years. Current estimates in 34 countries around the world range from those seen in Malta (25.4% overweight, 7.9% obesity) to those seen in Lithuania (5.1% overweight, 0.4% obesity) (1). The consequences of childhood obesity are substantial, both short and long term (2). Obesity-related physical symptoms in children and adolescents include increased cardiovascular disease risk factors, abnormal glucose metabolism, hepatic-gastrointestinal disturbances, sleep apnoea and orthopaedic complications. The most important long-term consequence of childhood obesity is its persistence into adulthood (3), with all the associated health risks (4).

Besides physical consequences, obesity is also associated with poorer psychosocial functioning and emotional distress (5,6). The aspects of psychosocial well-being that are believed to be most seriously compromised in obesity are a negative body image, a low self-esteem and less emotional well-being (7–9). Obviously, these types of problems by themselves already reduce the quality of life among youth. Therefore, interventions that are targeted at overweight or obesity should at least consider psychosocial factors associated with obesity. It may even be that one of the prime targets of these interventions is to prevent aggravation of these psychosocial problems.

Schools appear to be a logical setting for implementing population-based interventions to control childhood obesity. They have the opportunity to reach the vast majority of children and adolescents, and are in the unique position to actively promote both healthful eating and physical activity (10). Especially in recent years, many intervention programmes targeting childhood obesity have been developed and implemented at schools. It is suggested that school-based interventions improve some aspects of healthy behaviours, but that most of them do not have long-term effects on nutritional status. Only few studies show moderate positive effects on body mass index (BMI) and/or fat mass (11). Moreover, it is not clear if these school-based interventions may have (either positive or negative) side effects on psychosocial well-being of children. Nevertheless, a probable outcome of current obesity prevention is the unfortunate adverse one of having overweight and obese adolescents avoiding the help offered because they do not want to be lectured about their weight, humiliated of made to feel guilty (12). There is, however, no consensus yet about which messages should be used to decrease the risk for obesity without causing stigmatization and labelling of these children, and without leading to adverse psychosocial side effects that may increase, for example, the risk for unhealthy weight control practices and eating disorders (13).

The aim of the present paper is to gain insight in the extent to which psychosocial effects of obesity prevention programmes have been studied, to give an overview of the methods used to measure the particular psychosocial aspects and – if possible – to quantify the effects found.

Methods

Defining psychosocial problems

In its constitution, the World Health Organization defined health as 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' (14). This definition implicates that the concept of psychosocial well-being covers an important part of health. When psychosocial well-being is severely compromised, usually, it results in psychosocial problems. Psychosocial problems often are categorized as either emotional problems (or internalizing problems), behavioural problems (or externalizing problems) or other psychosocial problems (15). Examples of internalizing problems are being withdrawn and experiencing depressive symptoms. Examples of externalizing problems are aggressive behaviour and social problems. Having trouble sleeping is an example of 'other psychosocial problems'.

Search strategy

The primary purpose of the present review is to gain insight in the extent to which psychosocial effects of obesity prevention programmes have been studied. We made an inventory of psychosocial problems that would possibly be related to overweight or obesity. A narrative literature search for reviews relating psychosocial problems with overweight and obesity showed the following factors to be associated with overweight and/or obesity: social bias, prejudice, discrimination and bullying, problems with social interactions and relationships, and psychological or emotional problems like depression, body shape dissatisfaction, self-esteem and eating disorders (including binge eating disorders) (2,4,16–18). Because these problems were shown to be correlated with overweight and/or obesity, interventions aiming to prevent or to reduce body weight might be expected to show effects on these domains. Consequently, we developed a search strategy including key words referring to the aforementioned psychosocial problems. However, this attempt proved unsuccessful. The fact that our search strategy came to nothing may be explained by effects on psychosocial problems not being among the main research questions in evaluating obesity intervention studies.

Therefore, we deployed an alternative search strategy. The first step was to explore school-based obesity intervention studies, and as a second step, the selected intervention studies were screened on psychosocial outcomes (internalizing as well as externalizing). In the search for intervention studies, we combined studies obtained through screening published systematic reviews and meta-analyses with a systematic search of our own, covering the period not taken up in the reviews and meta-analyses included. Further, these two parts of our search strategy are discussed separately.

References from systematic reviews and meta-analyses
A PubMed search was conducted to search for relevant systematic reviews or meta-analyses on childhood obesity interventions. Reviews and meta-analyses were considered relevant if they were systematic, published in 2005 or 2006, if they involved prevention of overweight and/or obesity, and if they included studies among children. The keywords that were used were (synonyms of) 'obesity', 'intervention' and 'children', and the option 'limits' was used to select only reviews and meta-analyses. In total, 28 reviews and meta-analyses were identified from this search and were assessed on relevance by screening on titles and abstracts. The remaining reviews and meta-analyses ($n = 16$) were screened on full text. Seven reviews were found to be relevant for the present study (19–25). Based on the references provided in these reviews, 267 original papers published up to October 2005 were identified. For the review by Flynn *et al.*, these included both the mid- and high-quality school-based interventions. Because studies of low quality that were considered by Flynn *et al.* were not revealed in their publication, these studies were left aside. For the review by Summerbell *et al.*, both the included and excluded studies

were considered. For the other reviews, all studies described or included were considered for inclusion in the present review.

References from electronic library search

To obtain the most recent intervention studies, several databases (Medline, Embase, Biosis Previews, SciSearch and PsychInfo) were searched over the time frame January 2005–February 2008. We included the entire year 2005, meaning, this search would partly overlap publishing dates of the original papers selected from the seven reviews and meta-analyses identified in our previous search. Our search strategy was comparable with the strategy in the Cochrane review from Summerbell *et al.* (25) and contained the key-words 'obesity', 'intervention' and 'children', using various suffixes and synonyms. The detailed search strategy can be obtained from the corresponding author. With this search, 2754 papers were identified.

Selection strategy for intervention studies

Figure 1 presents the flow chart of the selection process. The aforementioned search strategies resulted in a total of 2901 papers (267 from the systematic reviews and meta-analyses, and 2754 from the electronic library search, excluding 120 duplicates). These papers were screened on title and, if necessary, on abstract by using the inclusion and exclusion criteria depicted in Table 1. After excluding irrelevant publications, the remaining 128 papers (74 from the systematic reviews and meta-analyses, and 54 from the electronic library search) were screened on full text, again by using the criteria in Table 1. Eventually, 53 interventions in 69 papers met these selection criteria (13,26–93).

Selection of studies was, for the most part, carried out by the first author of this review. The second author was consulted when there was uncertainty regarding selection criteria. If the first two authors did not come to consensus, the publication remained in the selection.

Selection of studies reporting on psychosocial outcomes

The full text of the 69 selected papers, covering 53 interventions, was screened on information about the impact of the intervention on psychosocial outcomes as defined for this review (see '*Defining psychosocial problems*' in the *Methods* section), either positive or negative. No further restrictions were made to the psychosocial constructs in order to give an overview of the literature that would be as broad as possible. At the same time, the original authors of the included intervention studies were contacted (by email or conventional mail) and asked to provide additional (un)published data about psychosocial outcome measures in their intervention study. Again, most of the work was

carried out by the first author. Only in cases in which it was not completely clear whether or not a publication met our inclusion criteria that inclusion was discussed with the second author until agreement was reached.

Characteristics of the selected intervention studies

For the studies that reported effects on psychosocial outcome variables, a detailed information was retrieved. This information included the name of the intervention study, the content and duration of the intervention, the target population, the intervention components, the study design, the follow-up period, the number of participants at baseline, the main findings on BMI and/or weight, the psychosocial outcome measures, the effect of the intervention on these outcome measures, and the measurement instruments. Information about the interventions was not only derived from the included papers, but also from other papers reporting on the same interventions.

By using the *Cochrane Handbook for Systematic Reviews of Interventions*, a domain-based critical appraisal was carried out estimating the risk of bias for each individual study selected for the present review (94). As suggested by the Cochrane Handbook, six domains were included:

1. Adequate sequence generation (Was the allocation sequence adequately generated?);

2. Allocation concealment (Was allocation adequately concealed?);

3. Blinding (Was knowledge of the allocated interventions adequately prevented during the study?);

4. Incomplete outcome data addressed (Were incomplete outcome data adequately addressed?);

5. Free of selective reporting (Are reports of the study free of suggestion of selective outcome reporting?); and

6. Free of other bias (Was the study apparently free of other problems that could put it at risk of bias?).

Results

From the majority of the authors (40 authors of 53 interventions), we received a reply to our request to provide information about psychosocial outcome measures in their studies. Six of these authors did provide additional information on psychosocial variables. Three authors provided unpublished information (34,47,84), one author referred to information in an additional publication about the intervention (95), and two authors replied that their study is still ongoing and psychosocial aspects are still under analysis (86) or have been collected in a larger study that is not yet ready for publication (75).

Based on publications about the 53 interventions as well as information provided by the authors, we found that 13
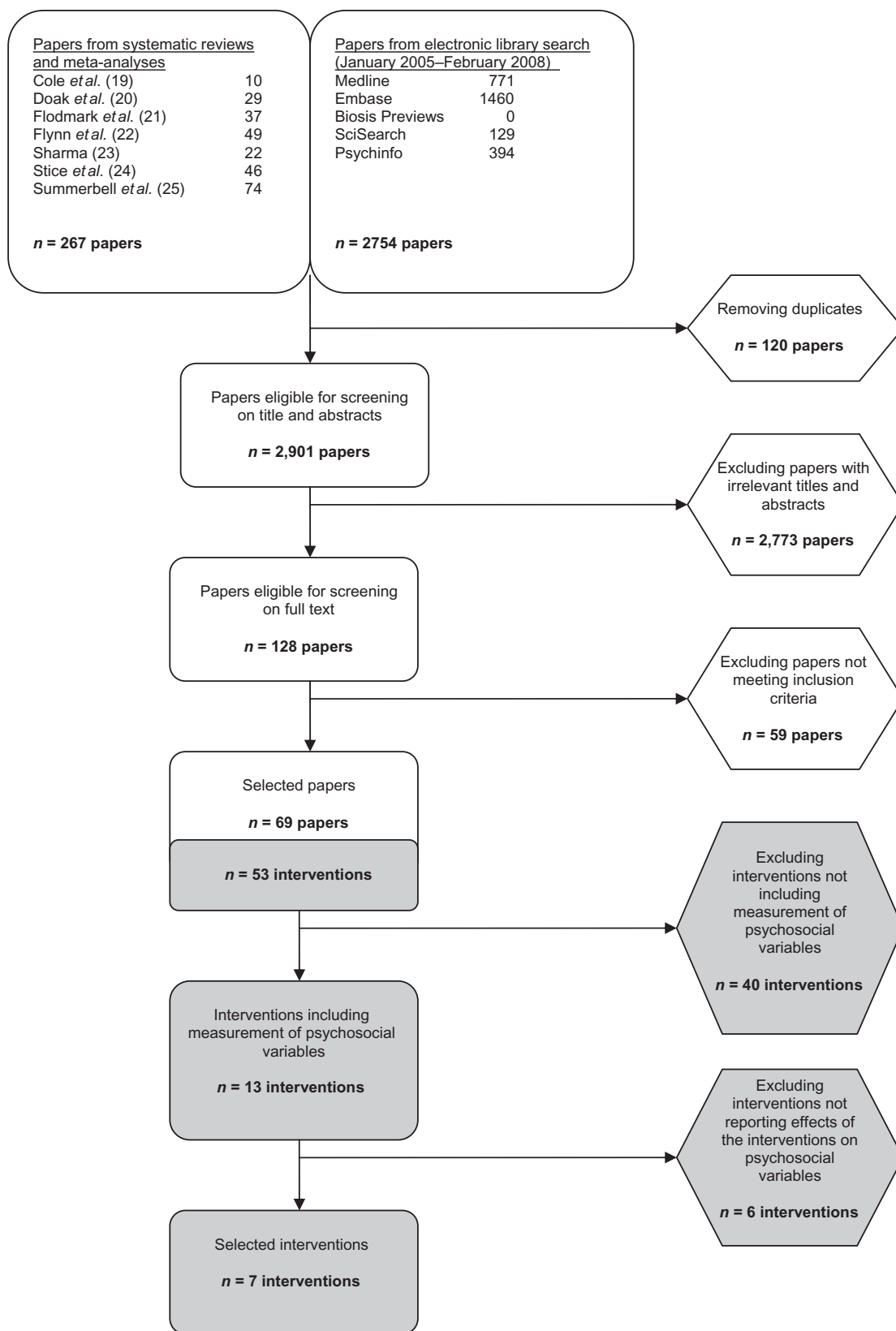
Figure 1 Flow chart of the selection process.

of the 53 selected interventions reported at least some measurement of aspects of psychosocial well-being of children (13,34,40,41,44,47,73,75–77,81,84,86). However, for four of these studies, information was available from either baseline or follow-up measurements, meaning, no effects of the intervention could be measured (34,41,47,81). As mentioned previously, two studies were still ongoing at the time the present paper was prepared for publication (75,86). Eventually, seven out of 13 interventions actually provided information on effects of the intervention on psychosocial outcome measures, either as net effects or as effects within an intervention group (13,40,44,73,76,77,84).

The estimated risk of bias for the seven intervention studies included in the present review is summarized in Table 2. In general, the studies had a high or an unclear risk of bias based on concealment and blinding of the particular

intervention condition as well as the way incomplete data were addressed in statistical analyses. Overall, Healthy Buddies and the study by Falk *et al.* incorporated the highest risk of bias. In general, a low risk of bias was estimated based on the allocation sequence of intervention conditions, selective outcome reporting and the risk of other types of bias. APPLES, Planet Health and the study by Robinson *et al.* incorporated the lowest risk of bias, followed by New Moves (Table 2).

The characteristics of these seven intervention studies are depicted in Tables 3 and 4. All but one intervention targeted primary or elementary schoolchildren, varying from 5 to 12 years of age. Only the New Moves intervention (13) targeted teenage girls from 14 to 17 years of age. Four out of seven interventions were performed in the USA (13,44,73,77), one in the UK (76), one in Canada (84) and one in Israel (40). All interventions included a physical activity and/or diet components. Two interventions had additional components. New Moves also included social support sessions (13), and Healthy Buddies additionally included components to improve healthy body image (84). All but the training programme described by Falk *et al.* (40) were (randomized) controlled trials (Table 3).

The duration of the intervention programme varied from a few months to 3 years. In most cases, the evaluation period more or less coincided with the intervention programme. For the New Moves study and Healthy Buddies, the evaluation was carried out over a period of 8 and 10 months, respectively, in both cases, half of which covered the intervention programme. For the SPARK study, the evaluation study included in this review took place half way through the intervention programme of 2 years (Table 4).

Most studies found no effect on BMI or merely an effect in subgroups. Only the study by Robinson *et al.* found an effect on BMI throughout the study population (Table 4).

Reported variables were in the area of self-perception (including body image, self-esteem, self-worth and self-acceptance), social acceptance, healthy attitudes, cognitive competence, aggression and unhealthy weight control

Table 1 Inclusion and exclusion criteria for the selection of intervention studies

Inclusion criteria
1   The study must aim at the prevention of overweight or overweight-related diseases (like cardiovascular diseases)
2   The study must contain a diet or physical activity component or both
3   The study must aim at behavioural change with an educational approach
4   The study must be school based (only primary and secondary education)
5   The study must focus on school-aged children (5–18 years of age)
6   The study must report on body weight or adiposity (such as body mass index, skin-folds) at baseline and follow-up
7   The study must address a normal population: to be considered 'prevention' the participants should not be selected but should represent a normal group, in this case, a school population

Exclusion criteria
1   Studies published before 1990
2   Studies published in languages other than English
3   Studies focusing specifically on treatment of obese children in a clinical setting and programmes designed to treat eating disorders
4   Non-scientific papers, editorials and debate articles

Table 2 Summary of the estimated risk of bias for the seven studies included in the present review

	Adequate sequence generation	Allocation concealment	Blinding	Incomplete outcome data addressed	Free of selective reporting	Free of other bias
APPLES (76)	+	?	–	+	+	+
Falk *et al.* (40)	+	–	–	?	+	–
Healthy Buddies (84)	–	–	+	–	–	+
New Moves (13)	+	–	?	?	+	+
Planet Health (44)	+	?	?	+	+	+
Robinson *et al.* (73)	+	+	?	?	+	+
SPARK (77)	+	?	?	?	+	?

+, low risk of bias; ?, unclear risk of bias; –, high risk of bias.

Table 3 Characteristics of the seven interventions included in the present review

Intervention	Population at baseline	Location	Study design	Programme duration	Description
APPLES (76)	634 boys and girls, 7–11 years	Ten primary schools, Leeds, UK	Cluster RCT	1 year	The programme was designed to influence diet and physical activity and not simply knowledge, targeted at the whole school community including parents, teachers and catering staff. The programme consisted of teacher training, modifications of school meals, and the development and implementation of school action plans designed to promote healthy eating and physical activity. Control schools received usual curriculum.
Falk *et al.* (40)	30 boys, mean age: 9 years	Two 4th grade classes in one elementary school in a community in Israel	Training programme	3 years	Progressive resistance-training programme, substituting the standard physical education programme. Classes were held twice per week for the first 2 years and three times per week for the third year. The total number of sessions was 160.
Healthy Buddies (84)	383 boys and girls*	Two elementary schools (kindergarten–7th grade), Canada	Controlled trial	21 weeks	The programme consisted of three main components of healthy living: being physically active (Go Move!), eating healthy foods (Go Fuel!) and having a healthy body image (Go Feel Good!). At the beginning of the school year, students in the 4th–7th grades were paired with kindergarten–3rd grade buddies. Each week, students in the 4th–7th grades at the intervention school received a 45-min healthy living lesson through direct instruction from the intervention teacher. Students in the 4th–7th grades then acted as peer educators, teaching a 30-min lesson to their kindergarten–3rd grade buddy. Each buddy pair also spent two 30-min structured physical activity sessions per week in the gymnasium, which allowed paired buddies to participate simultaneously.
New Moves (13)	201 girls, 14–17 years	Six high schools, Minneapolis (Minnesota), USA	Cluster RCT	16 weeks	High-school-based alternative physical education class, nutrition education and social support sessions for overweight girls or those at risk because of low levels of activity. The overall aim of the programme was to bring about positive changes in physical activity and eating behaviours for weight loss/maintenance, to help girls avoid unhealthy weight control behaviours and to help girls function in a thin-oriented society and feel good about themselves. Control schools received a minimal intervention that included written materials on healthy eating and physical activity that were distributed at the baseline assessment.
Planet Health (44)	480 girls, 10–14 years, mean age: 11.5 years	All 6th and 7th grades classes within ten primary schools, Boston (Massachusetts), USA	Cluster RCT	2 years	A 2-year primary school-based health and fitness education programme integrated into school curriculum. The Planet Health programme consists of teacher training workshops, 32 classroom lessons, physical exercise materials and wellness sessions for teachers and fitness funds. Control schools received their usual health curricula and 30 physical exercise classes.
Robinson *et al.* (73)	225 boys and girls, mean age: 8.9 years	All 3rd and 4th grades classes in two public elementary schools in San Jose (California), USA	RCT (Quasi-experimental because of only two schools)	6 months	Eighteen 30- to 50-min classroom lessons taught by the regular 3rd and 4th grade classroom teacher as part of the standard curriculum in the intervention school. Early lessons included self-monitoring and reporting of television, videotape and videogame use to motivate children to want to reduce the time they spent in these activities. Followed by a television turn-off and then encouragement to follow a 7-h week^{-1} budget. The control school only participated in the assessments.
SPARK (77)	549 boys and girls, mean age: 9.3 years	All 4th grade children from seven elementary schools in California, USA	Cluster RCT	2 years	The intervention has two components: physical education and self-management. The physical education curriculum consisted of three 30-min classes per week, divided into three segments: warming-up, health fitness activities and sports skills with cooling down. The purpose of the self-management curriculum was to promote physical activity outside of school by teaching children behaviour skills that they could apply to themselves. Self-management skills were taught in weekly 30-min classes by specialists or trained teachers, depending on the condition. Control schools received usual physical education.

*Mean age and age range not stated.
RCT, randomized controlled trial.

Table 4 Reported effects on BMI and/or weight and psychosocial outcome variables of the seven included interventions in the present review

Intervention	Follow-up	Main findings BMI and/or weight	Psychosocial variable	Measurement instruments*	Effects within intervention (I) and/or control (C) group (if reported)	Effects intervention versus control group
APPLES (76)	1 year	No effect on mean BMI	Global self-worth	Self-perception profile for children (Harter, 1985)	I: +0.32 (95% CI: 0.0, 0.64)	ns
			Dietary restraint	A measure of dietary restraint for children aged 8 (Hill *et al.*, 1998)	nr	ns
			Satisfaction with body image	Adapted body shape perception scale (Hill *et al.*, 1994)	nr	ns
Falk *et al.* (40)	3 years	Level of adiposity strong predictor of the training effect of the lower limbs	Self-concept	Perceived Physical Competence Scale (Lintunen, 1987; Lintunen *et al.*, 1995; Ostrow, 1996)	I: mean Perceived Physical Competence Scale score decreased from 4.3 ± 0.4 to 3.8 ± 0.3	na
Healthy Buddies (84)	10 months	No effect on mean BMI in kindergarten–3rd grade. For the 4th–7th grades, a statistically significant intervention effect was found for BMI in favour of the intervention group	Cognitive competences	Harter-Perceived Competence Scale for Children (Harter, 1982)	Kindergarten–3rd grade†: I: mean +0.4 (SD 0.5) $P < 0.001$ C: mean +0.3 (SD 0.6) $P = 0.038$ 4th–7th grades†: ns	ns
			Social acceptance	Harter-Perceived Competence Scale for Children (Harter, 1982)†	Kindergarten–3rd grade: nr 4th–7th grades: I: mean −0.1 (SD 0.6) $P = 0.382$ C: mean −3.3 (SD 1.3) $P < 0.001$	ns
			Physical competences	Harter-Perceived Competence Scale for Children (Harter, 1982)	Kindergarten–3rd grade†: I: mean +0.2 (SD 0.5) $P = 0.003$ C: mean +0.2 (SD 0.4) $P = 0.049$ 4th–7th grades: ns	ns
			General self-worth	Harter-Perceived Competence Scale for Children (Harter, 1982)	Kindergarten–3rd grade: ns 4th–7th grades: ns	ns
			Body image perception	Figural Rating Scale (4th–7th grades; Stunkard *et al.*, 1983) & Schematic Figures for kindergarten–3rd grade (Collins, 1991)	Kindergarten–3rd grade: ns 4th–7th grades: ns	ns
			Disordered eating	ChEAT (Maloney, 1988)	Kindergarten–3rd grade: ns 4th–7th grades: ns	nr
			'I wish that I could change the way that I look'	Healthy Living Questionnaire (Stock & Miranda, unpublished)	Kindergarten–3rd grade: nr 4th–7th grades†: I: mean +0.4 (SD 1.3) $P = 0.011$ C: mean +0.3 (SD 0.6) $P = 0.038$	ns

Table 4 *Continued*

Intervention	Follow-up	Main findings BMI and/or weight	Psychosocial variable	Measurement instruments*	Effects within intervention (I) and/or control (C) group (if reported)	Effects intervention versus control group
			'I am happy with the way that I look'	Healthy Living Questionnaire (Stock & Miranda, unpublished)	Kindergarten–3rd grade: nr 4th–7th grades†: I: mean +0.4 (SD 1.4) $P < 0.05$ C: mean +0.1 (SD 1.6) $P < 0.05$	ns
			'I take time to relax'	Healthy Living Questionnaire (Stock & Miranda, unpublished)	Kindergarten–3rd grade: nr 4th–7th grades†: I: mean +0.6 (SD 1.8) $P < 0.05$ C: mean −0.2 (SD 1.6) $P < 0.05$	ns
			'I gobble my food quickly'	Healthy Living Questionnaire (Stock & Miranda, unpublished)	Kindergarten–3rd grade: nr 4th–7th grades†: I: mean +0.4 (SD 1.4) $P < 0.05$ C: mean −0.1 (SD 1.4) $P < 0.05$	ns
			'I eat when I am bored'	Healthy Living Questionnaire (Stock & Miranda, unpublished)	Kindergarten–3rd grade: nr 4th–7th grades†: I: mean +0.5 (SD 1.6) $P < 0.05$ C: mean +0.0 (SD 1.3) $P < 0.05$	ns
New Moves (13)	8 months	No effect on mean BMI	Unhealthy weight control behaviours	List of nine unhealthy and five health weight control methods: respondents indicate use of each method over past month (yes/no)	nr	ns
			Binge eating	One question: 'In the past month, have you ever eaten so much food in a short period of time that you would be embarrassed if other saw you (binge eating)?'	nr	ns
			Self-acceptanc	Perceived Competence Scale for Children (Harter, 1982)	nr	ns
			Athletic competence	Perceived Competence Scale for Children (Harter, 1982)	nr	ns
			Self-worth	Perceived Competence Scale for Children (Harter, 1982)	nr	ns
			Media internalization	Four questions assessing internalization of media ideals for appearance/body shape (Heinberg et al., 1995; Neumark-Sztainer et al., 2000)	nr	ns

Table 4 *Continued*

Intervention	Follow-up	Main findings BMI and/or weight	Psychosocial variable	Measurement instruments*	Effects within intervention (I) and/or control (C) group (if reported)	Effects intervention versus control group
Planet Health (44)	21 months	Favourable effect on BMI among girls, but not among boys	Disordered weight control behaviour (96)	Three questions about dieting, vomiting, taking laxatives or diet pills in the past 30 d to lose weight (Brener *et al.*, 1995) were combined to create a single disordered weight-control behaviour variable for analyses	nr	Girls in intervention schools were less than half as likely to report use of purging or diet pills at follow-up compared with girls in control schools (odds ratio: 0.41, 95% CI: 0.22, 0.75)
Robinson *et al.* (73)	7 months	Favourable effect on BMI, waist circumference and waist–hip ratio	Peer-rated aggression	Fifteen questions about the behaviour of classmates including aggressive behaviour items, popularity items and prosocial items (Eron *et al.*, 1971; Walder *et al.*, 1961)	nr	−2.4 % nominated (95% CI: −4.6, −0.2)
			Observed physical aggression	A 60% random sample was selected for direct observation during free play, using the protocol by Joy *et al.* (1986)	nr	ns
			Observed verbal aggression	Direct observation during free play, using the protocol by Joy *et al.* (1986)	nr	−0.10 acts min^{-1} (95% CI: −0.18, −0.03)
			Perceptions of a mean and scary world	Twelve items assessing their perceptions of a mean and scary world adapted from Gerbner *et al.* (1979); Singer *et al.* (1984) and Pingree & Hawkins (1981)	nr	ns
			Parent report of aggressive behaviour	Parent report form of the Child Behaviour Checklist (Achenbach, 1991)	nr	ns
			Parent report of delinquent behaviour (95)	Parent report form of the Child Behaviour Checklist (Achenbach, 1991)	nr	ns
SPARK (77)	1 year	No effect on mean BMI	Self-perception (101)	Three self-perception variables (perceived physical competence, body image and global self-concept) were assesses with a modified form of scales developed by Harter (1982, 1985)	I: I: boys' participation was significantly correlated ($r = 0.13$, $P < 0.05$) with improvement in self-perception. For girls no association was found	nr

*The references of these publications are not cited, but can be found in the original papers.
†This information was retrieved through personal communication.
BMI, body mass index; C, control group; I, intervention group; na, not applicable; nr, not reported; ns, not significant.

behaviours, binge eating, athletic competence, and media internalization (Table 4). Although five out of seven studies (13,40,76,77,84) included more or less the same psychosocial construct in their evaluation (global self-worth, self-concept, self-competence, etc.), none of them used the exact same measurement instrument (Table 4).

Most interventions (four out of seven) included in the present review reported no statistically significant effect of the intervention, either as a net effect or an effect within the intervention group on the psychosocial variables under study. In Table 4, these null associations are indicated with 'ns'. Moreover, in four cases, the reported effect was an effect within the intervention population. In the APPLES study, the only significant difference in psychosocial variables was a small increase in global self-worth (0.32; 95% confidence interval [CI]: 0.0, 0.64) for obese children in the intervention schools. In the training programme reported by Falk *et al.*, the mean Perceived Physical Competence Scale score was significantly ($P \leq 0.05$) lower at the end of the third year compared with the beginning of the first year of the intervention (3.8 ± 0.3 compared with 4.3 ± 0.38). In the SPARK study, boy's participation in the programme was significantly correlated with improvements in self-perception (Pearson correlation: $r = 0.13$, $P < 0.05$). Surprisingly, the level of participation was not associated with any improvements among girls (Table 4). In Healthy Buddies, for many of the psychosocial variables under study, statistically significant changes were found in either or both the intervention and the control group.

Five out of seven intervention studies reported the measurement of a net effect on psychosocial variables. For two of those, a statistically significant effect was found. Planet Health was found to be effective in decreasing the use of purging or diet pills among girls (44,96). Girls in the intervention schools were less than half as likely to report purging or using pills at follow-up compared with girls in control schools (odds ratio: 0.41; 95% CI: 0.22, 0.75; Table 4). Robinson *et al.* reported that peer ratings of aggression (% nominated aggressive by peers) and observed verbal aggression (acts min⁻¹) showed a statistically significant larger decrease (−2.4%; 95% CI: −4.6, −0.2) and −0.10 acts min⁻¹ (95% CI: −0.18, −0.03) for children in the intervention group than for children in the control group (Table 4) (73,95).

Discussion

The purpose of this paper was to gain insight in the extent to which psychosocial effects of obesity prevention programmes have been studied, to give an overview of the methods used to measure these particular psychosocial aspects and – if possible – to quantify the effects found.

Fifty-three interventions were selected to be reviewed. Seven out of 53 selected intervention studies (13%)

reported effects of the interventions on psychosocial variables, either as net intervention effect or as an effect within the intervention group, and were therefore included in the present review. For the majority of the psychosocial variables, no statistically significant intervention effect was found. Two out of seven intervention studies included in the present review reported a statistically significant net intervention effect. Psychosocial variables that were found to be positively influenced by the particular interventions were unhealthy weight control behaviours such as purging and using pills, peer-rated aggression, and observed verbal aggression.

The present review enclosed an extensive search among reviews, meta-analyses and databases, and resulted in seven intervention studies paying at least some attention to psychosocial factors in their effect evaluation. Moreover, we did contact authors from papers we considered. At the same time, we have to acknowledge that we did not search every available database. For example, we did not search in Dissertation Abstracts and also did not include 'grey literature' in our search. These other databases may have yielded additional studies that were not considered in the present review.

As in all reviews, we need to consider the fact that the particular search strategy we used might have caused selection bias. For intervention studies published between 1990 and 2005, we used papers that were described in other reviews and meta-analyses. Obviously, this caused us to miss potentially interesting papers that were excluded by these reviews and meta-analyses. However, the fact that we have analysed seven reviews and meta-analyses should have limited this problem to at least some extent.

The selection process for this review was carried out by two of the authors of this paper. However, they did not select publications independently from each other. This may be noted as a study limitation.

In the selection criteria for the selection of studies, we did not include a criterion for the methodological quality of studies. The main reason for this was that we wanted to describe all studies that we found, including studies that would fail to pass some quality tests. However, the seven studies included in the present review were critically appraised concerning the risk of bias. In the end, all but two of the studies included (13,44,73,76,77) comprised of a randomized controlled trial, considered to provide a high level of evidence if conducted properly. The other two studies were a controlled trial (84) and a training programme (40). Estimating the risk of bias did, however, reveal that in most of the studies included, three out of the six domains of bias taken into account showed a high risk of bias. At the same time, for most of the studies included, a low risk of bias was suggested for the three other domains. Domains that were frequently scored 'unclear' or 'high risk of bias' were 'allocation concealment', 'blinding'

and 'addressing incomplete data'. Bias in the first two domains could have diluted the intervention effects found; bias in the third domain could have altered results both negatively and positively. Therefore, we cannot exclude the risk of bias in the results described in the present review. Moreover, it is unclear to what extent a diluted result on, for example, BMI would have affected psychosocial well-being.

The only two intervention programmes that showed a positive net intervention effect on psychosocial variables were the Planet Health study (44) and the intervention by Robinson *et al.* (73). Both these interventions were integrated into a standard school curriculum and included an intensive programme, which may have been the success factors of these interventions. The intervention study by Falk *et al.* (40) was the only study that found a negative impact on psychosocial outcomes. After 3 years of intervention, the boys that participated in the training programme had a significant lower self-concept compared with the start of the intervention. Because there was no control group included, it remains unclear whether the change in self-concept was because of maturation or to participation in the programme.

In the literature, examples can be found of intervention studies that are specifically designed to improve psychosocial outcomes such as body image satisfaction, global self-esteem, and eating attitudes and behaviours in children and adolescents, but do not aim at prevention of overweight. Those studies showed promising results in improving psychosocial well-being of children (97–99). In our review, New Moves (13) and Healthy Buddies (84) were the only interventions that particularly included psychosocial components. Although we would expect that integrating such components into preventive obesity interventions may result in positive intervention effects on psychosocial well-being, in both studies, no statistically significant effects were found for the intervention group compared with the control group. Neumark-Sztainer *et al.* suggested they perhaps failed to proof an effect of the New Moves intervention on psychosocial outcome measures because of limited statistical power, the possibility that the outcome measures they used did not adequately assess the process of change in psychosocial outcomes and the fact that expectations for short-term interventions may have been too great (13). Stock *et al.* argued that most schoolchildren in the sample at baseline had normal scores for the variables under study and that the size of the sample was too small to determine whether children with extreme scores had specifically benefited from the intervention (84). Another way of looking at the results of these two studies is to say that in fact they have not worsened psychosocial aspects and therefore may – to a certain extent – be considered successful. Especially considering the fact that the interventions included in the present review did not particularly target

the obese population, no change in psychosocial constructs may in fact be a positive finding for studies like the ones included in the present review. The real concern is of course when an obesity prevention programme causes a reduction in psychosocial well-being as seen in the intervention published by Falk *et al.*

To our knowledge, only one other review examined the impact of school-based obesity interventions on psychosocial outcomes. As part of their synthesis, Flynn *et al.* studied the effects of interventions on psychosocial outcome measures like self-esteem, body image, stress level and feelings of support (22). Besides school-based interventions, Flynn *et al.* also included home, community and clinical interventions in their synthesis. In total, 49 papers on school-based interventions were included by Flynn *et al.*, whereas the present review included a total of 69 papers (53 school-based interventions). Seventeen intervention studies occurred in both reviews (13,26,28,37,40,44,46,51,53,61,63,66,67,73,82,85,89). For two studies, Flynn *et al.* reported psychosocial outcomes, whereas we did not find any reporting on psychosocial variables (46,82). Possibly, Flynn *et al.* used different criteria with regard to psychosocial outcomes resulting in this apparent discrepancy.

Flynn *et al.* included papers up to July 2003 in their review. Despite our longer search period (up to and including February 2008), we hardly found any other intervention studies reporting on psychosocial outcomes. This suggests that most intervention studies still do not contain measurements of psychosocial outcomes, whereas the need for a well-designed evaluation study including all kinds of psychosocial aspects has been stressed many times in the past (12,20). On the other hand, it seems that some positive ameliorations have been made. For example, an ongoing Swiss study (100) demonstrated in their study protocol an extensive evaluation of psychosocial variables, such as social climate in school, stress coping, social anxiety, depressed mood, self-esteem and drug abuse.

Based on our findings, we can underline the recommendation that intervention studies should evaluate a whole range of aspects of psychosocial outcomes, including internalizing as well as externalizing problem behaviours, such as self-concept, eating disturbances and social problems. In order to facilitate comparability between studies, preferably standardized measurement instruments should be developed, validated and used. Up until this moment, only very few studies have evaluated the effects of school-based obesity prevention programmes on aspects of psychosocial well-being, which prevents us from drawing conclusions covering the whole or at least a considerable part of the area of psychosocial well-being. It seems, however, that most promising results may be expected from interventions that include a strategy that is integrated into the standard school curriculum and/or a strategy that is set out to

improve the psychosocial well-being of the participants. It is recommended that in the future, school-based obesity prevention programmes will be evaluated in a uniform way on a broad range of psychosocial aspects.

Conflict of Interest Statement

No conflict of interest was declared.

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