

*Health Development Agency*

The management of  
obesity and overweight

*An analysis of reviews  
of diet, physical activity and  
behavioural approaches*

*Evidence briefing*

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# Foreword

In 1999 the white paper, *Saving Lives: Our Healthier Nation*, was published (Department of Health, 1999). It signalled that the Health Development Agency (HDA) would be established and that it would have, as one of its roles, building the evidence base in public health with a special focus on reducing inequalities in health. In April 2001 the Department of Health published its Research and Development Strategy. The strategy identified the task for the HDA as:

*'Maintaining an up-to-date map of the evidence base of public health and health improvement, advising on the setting of standards in the light of evidence for public health and health promotion practice, and effective and authoritative dissemination of evidence to practitioners'* (Department of Health, 2001).

To translate this into reality the HDA has developed a number of ways of taking a systematic approach to compiling the evidence, identifying gaps and making the evidence base accessible. The publication of this, one in a series of evidence briefings, marks a significant milestone in that activity.

This evidence briefing is a review of reviews about the management of obesity and overweight. The necessity for reviewing reviews, or tertiary-level research, stems from the proliferation over the last decade or more of systematic and other types of review in medicine and public health. The HDA is publishing further examples of evidence briefings which deal with alcohol misuse, teenage pregnancy and parenthood, HIV/AIDS transmission, sexually transmitted infections, the prevention of low birth weight, smoking, drug use, accidental injuries in children and older people, depression in older people, community development and health impact assessment (see HDA catalogue for full list: [www.hda.nhs.uk](http://www.hda.nhs.uk)). Other briefings will be about the

promotion of physical activity, breastfeeding, good mental health, and social support in pregnancy.

Taken together these briefings will provide a comprehensive synthesis of the evidence drawn from systematic and other kinds of reviews. They will all be available on the HDA's website [www.hda.nhs.uk/evidence](http://www.hda.nhs.uk/evidence) and the electronic versions will be updated on a regular basis as new evidence becomes available.

The first editions of the briefings have been based on evidence drawn from systematic and other kinds of reviews. This means that the type of evidence that does not traditionally find its way into reviews has not been considered in detail for these documents. In future it is planned to extend the coverage of evidence beyond reviews to other methodologies and other types of study, where these are available.

The construction of the evidence base has involved collaboration with a number of partners who have interests and expertise in practical and methodological matters concerning the drawing together of evidence and its dissemination. In particular the HDA would like to acknowledge the following: the Centre for Reviews and Dissemination at the University of York, the EPPI-Centre at the Institute of Education, University of London, Health Evidence Bulletins Wales, the ESRC UK Centre for Evidence Based Policy and Practice at Queen Mary College, University of London and its nodes at the City University London and the MRC Public Health Sciences Unit at the University of Glasgow, members of the Cochrane and Campbell collaborations, the United Kingdom and Ireland Public Health Evidence Group and the members of the Public Health Evidence Steering Group. This latter organisation acts as the overall guide for the evidence-building project of the HDA. The cooperation of colleagues in these institutions and organisations has

been of significant help in the general work in preparing the framework for how we assess the evidence. The HDA is, however, responsible for the presentation and organisation of the material in the briefings.

We would also like to express our gratitude to the obesity and overweight evidence base reference group and to HDA colleagues who assisted in organising the literature searches.

Every effort has been made to be as accurate and up to date as possible in the preparation of this document. However, we would be very pleased to hear from readers who would like to comment on the content or on any matters relating to the accuracy of the documents. We will make every effort to correct any matters of fact in subsequent editions of the documents. Comments can be made by using our website [www.hda.nhs.uk/evidence](http://www.hda.nhs.uk/evidence)

**Professor Michael P. Kelly**  
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# Contents

<b>Foreword</b>	<b>iii</b>
<b>Summary</b>	<b>1</b>
<b>Introduction</b>	<b>11</b>
The HDA Evidence Base	11
Who is this briefing for?	12
What is effectiveness?	12
Obesity and overweight	13
Prevalence of obesity and overweight	13
Causes of obesity and overweight	14
Why is obesity important?	14
Benefits of the management of obesity and overweight	15
The complexity of obesity	16
Methodological issues	16
<b>Methodology</b>	<b>19</b>
Identification of the relevant literature	19
Data handling process	20
<b>Evidence Base papers</b>	<b>21</b>
<b>Evidence</b>	<b>26</b>
Prevention of obesity and overweight in children	26
School-based health promotion programme	26
School-based physical activity programmes	26
School-based multi-faceted interventions	27
Family-based health promotion interventions	27
Family-based behaviour modification programmes	27
Treatment of obesity and overweight in children	27
Targeting parents and children together (family-based physical activity and health promotion interventions)	28
Family-based programmes with parents as agents of change	28
Family-based behaviour modification programmes	28
Behaviour modification programmes with no parental involvement	29
Exercise treatment programmes (within a laboratory setting)	29

Prevention of obesity and overweight in adults	29
Treatment of obesity and overweight in adults	30
Dietary intervention	30
Low calorie diets (1,000-1,500 kilocalories per day)	30
Clinically prescribed very low calorie diets (400-500 kilocalories per day)	30
Low fat diets	31
Dietary fibre	32
Physical activity interventions alone	32
Physical activity and diet combined	32
Behavioural and/or cognitive therapy	33
Intra-abdominal fat	34
Maintenance of weight loss in adults	34
Comprehensive interventions in adults	36
Settings	36
Treatment of childhood obesity and overweight in schools	36
Worksite health promotion programmes	37
Healthcare settings and the role of health professionals	37
Pregnancy	38
Conclusion	39
Gaps in the evidence base and recommendations for research	42
Glossary	45
References	47
Appendix 1: Search strategy	50
Appendix 2: Evidence base – critical appraisal form	52

# Summary

## Introduction

This briefing presents the current evidence from selected good quality systematic reviews and meta-analyses published since 1996. The review will be updated regularly as new evidence becomes available and can be accessed via [www.hda.nhs.uk/evidence](http://www.hda.nhs.uk/evidence). It aims to identify diet, physical activity and behavioural interventions shown to be effective in the management of obesity and overweight, and is intended to inform policy and decision makers, NHS providers, public health physicians and other public health practitioners in the widest sense.

Obesity and overweight are conditions in which weight gain (predominantly fat) has reached the point of endangering health. The prevalence of overweight and obesity has increased rapidly over the past two decades in the developed world and it has been described by the World Health Organization as 'a global epidemic' (WHO, 1998). The prevention and management of obesity has been a national governmental policy concern for a number of years; the Chief Medical Officer's Annual Report 2002 (Department of Health, 2003) highlighted obesity as 'the health time bomb' and recognised that obesity is a growing challenge for government as a whole.

Since 1980 the prevalence of obesity has nearly trebled in the UK and is continuing to increase. When combining the overweight and obese groups nearly two thirds of men and over half of women were either overweight or obese in 2001 (Joint Health Surveys Unit, 2002). Data from the Health Survey for England (Joint Health Surveys Unit, 2002) revealed that age, education, social class and prosperity have an important influence on the risk of becoming obese. The prevalence of obesity is also rising in children, regardless of the assessment method used. The Health Survey for England (Joint Health Surveys Unit

on behalf of the Department of Health, 2002) reports that a considerable number of children are either overweight or obese – for example, in 2001 8.5% of 6 year olds and 15% of 15 year olds were obese. These findings were based on a body mass index (BMI) above the 95th percentile to represent obese and a BMI above the 85th percentile to represent overweight. The survey also showed that between 1996 and 2001 the proportion of overweight children (aged 6-15 years) increased by 7% and obese children by 3.5%.

The findings of the 1997 National Diet and Nutrition Survey (NDNS) in British young people (4-18 years) also found that the prevalence of overweight has increased to 15.4% and that 4% of the young people surveyed were obese (Jebb et al., 2003). Furthermore, this survey found that inequalities in the prevalence of overweight and obesity also exist in children, with higher rates among Asian groups, lower social classes and children living in Wales and Scotland (Jebb et al., 2003).

Obese people are more likely to suffer from a number of serious chronic diseases, many of which are life limiting. Besides the physical effects, there are also considerable psychological and social effects. Weight loss in overweight and obese individuals improves physical, metabolic, endocrinological and psychological complications, often dramatically, and may also reduce obesity-related mortality.

Obesity and overweight is a considerable burden to England economically (National Audit Office, 2001). In 1998, over 18 million days of sickness were attributed to obesity, and the total estimated cost of obesity was £2.6 billion for England. If the prevalence of obesity continues to rise at the present rate until 2010, this annual cost would increase by £1 billion, or over a third, to around £3.6 billion.

## Methodology

This evidence briefing is a 'review of reviews', that is, a synthesis of high quality systematic reviews, meta-analyses and other syntheses of lifestyle interventions to prevent and treat obesity and overweight and maintain weight loss. It does not assess the effectiveness of surgical or pharmacological treatments for obesity, as this work is the remit of the National Institute for Clinical Excellence (NICE). Other literature or narrative reviews have informed the context and commentary in this briefing, but have not been accepted for the HDA Evidence Base. The briefing is not a systematic review of primary data. Furthermore, we have not conducted a systematic search for practice data ('good' or 'best' practice studies) or grey literature. While we believe such data have an important place in the process of gathering evidence to support decisions about effective practice, we currently lack the tools to systematically search and rate such data in an appropriate and sensitive way.

We used the following procedures to identify the reviews to be included in the briefing:

- Systematic searching of the literature
- Selection of relevant systematic reviews and meta-analyses
- Critical appraisal of selected reviews by two readers for transparency, systematicity and relevance
- Assessment of the strength of the evidence, gaps in the evidence identified and recommendations made for further research.

We make a number of **summary statements** about whether certain interventions were effective, based on the evidence from the included Evidence Base papers. Each summary statement categorises the evidence as follows:

- **Evidence of effectiveness:** derived from systematic reviews and meta-analyses which included four studies or more, where the results were all in agreement
- **Limited evidence of effectiveness:** derived from systematic reviews and meta-analyses that included three studies or less
- **Lack of evidence of effectiveness:** applied to interventions in systematic reviews and meta-analyses which showed no current impact on obesity and overweight outcomes
- **Conflicting or inconclusive evidence:** derived from systematic reviews and meta-analyses where the interpretation and conclusions of the papers were not in agreement.

## Findings

Thirteen systematic reviews and meta-analyses met the criteria outlined above and were included onto the HDA Evidence Base.

### Prevention of obesity and overweight in children and adolescents

Four systematic reviews have investigated the prevention of obesity and overweight in children (Campbell et al., 2001; NHS CRD, 1997; Hardeman et al., 2000; NHS CRD, 2002). Since the NHS CRD (2002) review has superseded NHS CRD (1997), the following findings do not include those from the 1997 review.

- There is evidence to support the use of multi-faceted school-based interventions to reduce obesity and overweight in schoolchildren, particularly girls. These interventions included: nutrition education, physical activity promotion, reduction in sedentary behaviour, behavioural therapy, teacher training, curricular material, and modification of school meals and tuck shops.

Currently, there is limited\* evidence of effectiveness:

- To support school-based health promotion (classroom curriculum to reduce television, videotape and video game use) for the prevention of obesity and overweight in children
- That family-based behaviour modification programmes (family therapy in addition to diet education, regular visits to a paediatrician and encouragement to exercise) impede weight gain in obese children.

Currently, there is a lack of evidence of effectiveness:

- For school-based physical activity programmes led by specialist staff or classroom teachers for the prevention of obesity and overweight in children
- That family-based health promotion interventions impact on obesity and overweight. These interventions focused on dietary and general health education and increased activity, and involved sustained contact with children and parents.

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\* Limited is arbitrarily defined as three studies or less.

## Treatment of obesity and overweight in children and adolescents

Three systematic reviews investigated the treatment of obesity and overweight in children (NHS CRD, 1997; NHS CRD, 2002; LeMura and Maziekas, 2002).

There is evidence:

- That targeting parents and children together (family-based interventions, involving at least one parent with physical activity and health promotion) is effective in treating obesity and overweight in children
- To support the use of multi-faceted family-based behaviour modification programmes, where parents take primary responsibility for behaviour change, in the treatment of obesity and overweight in primary schoolchildren. The programmes comprised diet, exercise, reducing sedentary behaviour and lifestyle counselling, with training in child management, parenting and communication skills
- To support the use of laboratory-based exercise programmes in the treatment of childhood obesity. These programmes consisted of walking, jogging, cycle ergometry, high-repetition resistance exercise and combinations within a laboratory setting, as opposed to free-living lifestyle activity interventions.

Currently, there is limited\* evidence that behaviour modification programmes with no parental involvement are effective in the treatment of childhood obesity and overweight. These programmes included a reduced calorie diet and an exercise programme, combined with cognitive-behavioural 'obesity-training', or muscle relaxation training.

Currently, there is a lack of evidence for family-based behaviour modification programmes for the treatment of childhood obesity. These programmes included behaviour modification, dietary and exercise education with a mix of sessions involving the child, parent(s) and, in some cases, the entire family. At present there is insufficient evidence to recommend any specific programme.

## Prevention of obesity and overweight in adults

Three reviews have investigated the prevention of obesity in adults (NHS CRD, 1997; Douketis et al., 1999; Hardeman et al., 2000). NHS CRD (1997) and Douketis et al. (1999) have included the same three community-based studies in their analysis. The evidence from these reviews was found to be mixed and inconclusive in terms of effectiveness.

Considering the potential scale of obesity and the associated health, economic and social consequences, the development of effective strategies to prevent obesity is a priority.

- There is inconclusive evidence regarding the effectiveness of community-based interventions (for example, seminars, mailed educational packages and mass media participation) for the prevention of obesity and overweight in adults.

## Treatment of obesity and overweight in adults

### *Diet*

There is a large quantity of evidence on the effectiveness of dietary interventions for the treatment of obesity and overweight. The NHS CRD (1997), the National Heart, Lung and Blood Institute (NIH, 1998), Astrup et al. (2000), and Pirozzo et al. (2002) examined this topic. The most common dietary interventions are low calorie diets, very low calorie diets and low fat diets.

There is evidence to:

- Support the effectiveness of low calorie diets (1,000-1,500 kilocalories per day)
- Suggest that clinically prescribed very low calorie diets (400-500 kilocalories per day) are more effective for acute weight loss than low calorie diets. However, there is conflicting evidence regarding the relative effectiveness of very low calorie diets versus low calorie diets over the long term (greater than one year)
- Support the effectiveness of low fat and low energy diets combined with energy restriction, and low fat diets alone (where 30% or less of total daily energy is derived from fat). However, there is conflicting evidence regarding their relative effectiveness.

There is conflicting evidence regarding the effectiveness of increased fibre intake.

### *Physical activity*

Only one systematic review (NIH, 1998) has examined the effectiveness of physical activity alone for the treatment of adult obesity and overweight. Two systematic reviews (NHS CRD, 1997; NIH, 1998) considered diet and physical activity interventions. However, while reporting that physical activity alone, diet alone, and physical activity combined with diet were effective interventions in their own right, these reviews were primarily concerned with their relative effectiveness.

There is evidence that:

- Increased physical activity is effective in producing a modest total weight loss. However, diet alone was more effective than exercise alone
- Physical activity alone, diet alone, and physical activity and diet combined are effective interventions.

There is conflicting evidence regarding the relative effectiveness of physical activity combined with diet versus diet alone or physical activity alone.

### *Behavioural and/or cognitive therapy techniques*

Behavioural therapy comprises any method to generate change in eating habits or lifestyle, including formal cognitive behaviour modification and training in behavioural skills. Cognitive therapy is also concerned with the modification of behaviour. The main principles of this treatment approach include the modification of current behaviour patterns, new adaptive learning, problem solving and a collaborative relationship between client and therapist. Cognitive therapy may be performed as part of standard behavioural therapy.

Three systematic reviews examined the effectiveness of behavioural therapy (which is usually used to support other weight loss components such as diet and physical activity) (NHS CRD, 1997; NIH, 1998; Douketis et al., 1999).

- There is evidence that a combination of behavioural therapy techniques in conjunction with other weight loss approaches is effective for the treatment of adult obesity over a one-year period.

Currently, there is limited\* evidence of effectiveness that supports:

- Extending the length of behavioural therapy
- Group behavioural therapy
- Correspondence courses
- Provision of structured meal plans and grocery lists
- The cognitive therapy technique of cue avoidance (individuals are asked to reduce their exposure to certain foods by making various changes to their habits)
- Cognitive rehearsal (rehearsing one's thoughts and behaviours prior to a potentially difficult situation, and planning healthy adaptive responses).

There is conflicting evidence on the effectiveness of involving spouses.

### *Intra-abdominal fat*

Intra-abdominal fat is centrally distributed within the abdominal cavity and is associated with greater health risk. Only one systematic review (NIH, 1998) has investigated the impact of a range of interventions (increased physical activity, low calorie diets and behavioural therapy) on intra-abdominal fat (as part of total weight loss and not as a site-specific benefit).

- There is evidence that low calorie diets are effective in decreasing intra-abdominal fat. The intra-abdominal fat loss occurs as part of total weight loss and is not a site-specific benefit
- Currently, there is limited evidence that increased physical activity is effective in reducing intra-abdominal fat in adults.

### **Maintenance of weight loss in adults**

Obese individuals who have successfully lost weight are prone to relapse. The NIH (1998) report describes the maintenance of a lower body weight as a 'major challenge', and all weight loss approaches should be followed by a weight maintenance phase to reduce the possibility of weight regain. Two systematic reviews (NHS CRD, 1997; Fogelholm and Kukkonen-Harjula, 2000) have examined the effectiveness of weight loss maintenance approaches.

Currently, there is limited\* evidence on the positive effects of:

- Self-help peer groups with therapist-led booster sessions on weight loss maintenance
- Daily weight charting on weight loss maintenance.

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\* Limited is arbitrarily defined as three studies or less.

There is conflicting or inconclusive evidence regarding the effectiveness of:

- Formula diet preparations in the maintenance of weight loss
- Standard or pre-packaged foods in the maintenance of weight loss
- Increased physical activity (1,500-2,000 kilocalories per week) for weight loss maintenance
- Continued therapist contact for weight loss maintenance.

Currently, there is a lack of evidence for the effectiveness of weight focus and skills focus programmes for the maintenance of weight loss. These consisted of monthly meetings providing training in dietary and exercise behaviours compatible with maintaining weight loss (skills focus), or discussing weight loss maintenance progress and addressing difficulties using a non-specific problem solving strategy (weight focus).

## Comprehensive interventions in adults

The NHS CRD (1997) review examined 11 comprehensive interventions where treatment and maintenance were combined in one intervention.

Currently, there is limited\* evidence to support the following strategies for weight treatment and maintenance:

- Continued therapist contact when combined with behavioural therapy and relapse prevention training
- Continued therapist contact by mail and telephone.

There is inconclusive evidence about the effectiveness of involving spouses. Currently, there is a lack of evidence to support the use of spaced versus massed booster sessions.

## Settings

### *Worksite health promotion programmes*

Two systematic reviews were identified (Henrikus and Jeffery, 1996; Shephard, 1996) which examined the use of worksite settings for the treatment of obesity and overweight. Due to the short-term nature of these studies, the findings should be treated with caution.

- There is evidence to support the use of worksite health promotion programmes for the treatment of obesity and overweight in adults. Positive programme factors include regular participation, intensity of the intervention, associated dieting, supervision of exercise and supplementation of the exercise programme with outreach, personal counselling and plant reorganisation.

### *Healthcare settings and the role of health professionals*

Three systematic reviews (NHS CRD, 1997; NIH, 1998; Harvey et al., 2001) have examined the effectiveness of healthcare settings or considered health professionals' management of obesity and overweight.

There is evidence to support improving the role of health professionals in the management of obesity and overweight, in particular by:

- Reminders to GPs to prescribe diets
- A brief educational training intervention on obesity management delivered by behavioural psychologists to GPs
- Encouraging shared care between GPs and a hospital service
- Use of inpatient obesity treatment services
- Training for both health professionals and leaders of self-help weight loss clinics.

## Conclusion

The tables summarise interventions shown to be effective in managing weight. In terms of treating child and adult obesity and overweight, there is an abundance of evidence about what interventions work, and there are also several promising interventions where further research is required. However, there is an urgent need for more evidence on prevention of obesity and overweight and maintenance of weight loss. Finally, there is a large amount of evidence that is either conflicting, inconclusive, or limited (based on less than three studies), particularly in relation to adults.

Obesity is a condition frequently described as an epidemic and is a focus of concern for government and non-government organisations around the world. The evidence base for the treatment of obesity and overweight is sound, but lacks evidence on strategies to prevent excessive weight gain and promote the

## The effectiveness of obesity and overweight interventions for children and adolescents

	Evidence of effectiveness ❶	Current limited evidence of effectiveness ❷	Conflicting or inconclusive evidence ❸	Current lack of evidence of effectiveness ❹
Prevention	<ul style="list-style-type: none"> <li>• School-based multi-faceted interventions (particularly for girls) (nutrition education, physical activity promotion, reduction in sedentary behaviour, behavioural therapy, teacher training, curricular material, modification of school meals and tuck shops)</li> </ul>	<ul style="list-style-type: none"> <li>• School-based health promotion (classroom curriculum to reduce television, videotape and video game use)</li> <li>• Family-based behaviour modification programmes to impede weight gain (family therapy in addition to diet education, regular visits to a paediatrician and encouragement to exercise)</li> </ul>		<ul style="list-style-type: none"> <li>• School-based physical activity programmes (led by specialist staff or classroom teachers)</li> <li>• Family-based health promotion (strong focus on dietary and general health education and increased activity, involving sustained contact with children and parents)</li> </ul>
Treatment	<ul style="list-style-type: none"> <li>• Targeting parents and children together (family-based interventions involving at least one parent, with physical activity and health promotion)</li> <li>• Multi-faceted family-based behaviour modification programmes, where parents take primary responsibility for behaviour change in primary schoolchildren (diet, exercise, reducing sedentary behaviour and lifestyle counselling, with child management, parenting and communication skills training)</li> <li>• Laboratory-based exercise programmes (walking, jogging, cycle ergometry, high-repetition resistance exercise and combinations within a laboratory setting, as opposed to free-living lifestyle activity interventions)</li> </ul>	<ul style="list-style-type: none"> <li>• Behaviour modification programmes with no parental involvement (reduced calorie diet and an exercise programme, combined with cognitive-behavioural 'obesity-training', or muscle relaxation training)</li> </ul>		<ul style="list-style-type: none"> <li>• Family-based behaviour modification programmes (behaviour modification, dietary and exercise education with a mix of sessions involving the child, parent(s) or in some cases the entire family)</li> </ul>

Key – Each summary statement sets out the evidence regarding effectiveness based on the following factors:

- ❶ Evidence of effectiveness: derived from systematic reviews and meta-analyses which included four studies or more, where the results were all in agreement
- ❷ Limited evidence of effectiveness: derived from systematic reviews and meta-analyses that included three studies or less
- ❸ Conflicting or inconclusive evidence: derived from systematic reviews and meta-analyses where the interpretation and conclusions of the papers were not in agreement
- ❹ Current lack of evidence of effectiveness: applied to interventions in systematic reviews and meta-analyses which showed no current impact on obesity and overweight outcomes

## The effectiveness of obesity and overweight interventions for adults

	Evidence of effectiveness ❶	Current limited evidence of effectiveness ❷	Conflicting or inconclusive evidence ❸	Current lack of evidence of effectiveness ❹
Prevention			<ul style="list-style-type: none"> <li>Community-based interventions</li> </ul>	
Treatment	<ul style="list-style-type: none"> <li>Low calorie diets (1,000-1,500 kilocalories a day) (weight loss benefit includes reducing intra-abdominal fat – no site-specific benefit)</li> <li>Clinically prescribed very low calorie diets (400-500 kilocalories a day)</li> <li>Low fat diets with energy restriction</li> <li>Low fat diets, without targeting energy restriction (where less than 30% of energy is from fat)</li> <li>Increased physical activity alone</li> <li>Diet and increased physical activity combined</li> <li>Combinations of behavioural therapy strategies in conjunction with other weight loss practices</li> <li>Worksite health promotion programmes</li> <li>Reminders to GPs to prescribe diets delivered by behavioural psychologists</li> <li>Brief educational intervention for GPs</li> <li>Encouraging shared care between GPs and a hospital service</li> <li>Use of in-patient obesity treatment services</li> <li>Training for both health professionals and leaders of self-help weight loss clinics</li> </ul>	<ul style="list-style-type: none"> <li>Extending the length of behavioural therapy</li> <li>Group behavioural therapy</li> <li>Correspondence courses</li> <li>Provision of meal plans and grocery lists</li> <li>Cue avoidance (reduce exposure to certain foods by making a variety of changes to their habits)</li> <li>Cognitive rehearsal (rehearse thoughts and behaviours prior to a potentially difficult situation and use healthy adaptive responses)</li> <li>Increased physical activity for the reduction of intra-abdominal fat – no site-specific benefit</li> </ul>	<ul style="list-style-type: none"> <li>Relative effectiveness of clinically prescribed very low calorie diets versus low calorie diets over the long term (more than one year)</li> <li>Relative effectiveness of low fat with energy restriction diets versus low fat diets without calorie restriction alone</li> <li>Increased dietary fibre intake</li> <li>Relative effectiveness of physical activity combined with diet versus diet alone or physical activity alone</li> <li>Spouse involvement</li> </ul>	
Maintenance		<ul style="list-style-type: none"> <li>Self-help peer groups with therapist-led booster sessions</li> <li>Daily weight charting</li> </ul>	<ul style="list-style-type: none"> <li>Continued therapist contact</li> <li>Higher physical activity levels</li> <li>Formula diet preparations</li> <li>Standard or pre-packaged food</li> <li>Increased physical activity (of 1,500-2,000kcal per week)</li> </ul>	<ul style="list-style-type: none"> <li>Programmes focus on training in dietary and exercise behaviours compatible with weight loss; skills focus on discussing weight loss maintenance progress and addressing difficulties</li> </ul>
Comprehensive (treatment and maintenance combined)		<ul style="list-style-type: none"> <li>Continued therapist contact combined with behavioural therapy and relapse prevention training</li> <li>Continued therapist contact by mail and phone</li> </ul>	<ul style="list-style-type: none"> <li>Spouse involvement</li> </ul>	<ul style="list-style-type: none"> <li>Spaced versus massed booster sessions</li> </ul>

maintenance of weight loss. Under research conditions, obesity can be successfully treated, but this learning is not always being translated into practice. There is an urgent need to address the barriers to effective treatment in clinical practice.

## Gaps in the evidence base

Based on the findings reported within the HDA Evidence Base papers and supplementary material, we have compiled a short list of the most urgent research needs (presented in no particular order).

Research should:

- Redress the balance by focusing on research that assesses the actual effectiveness of interventions, rather than the current research focus on measuring the prevalence and aetiology of obesity and overweight
- Focus on the prevention of obesity and overweight and the maintenance of weight loss in adults and children
- Redress the balance by focusing on 'upstream' interventions, such as policies or strategies at a national or regional level, and focusing on population and environmental interventions for the prevention of obesity and overweight in both children and adults, rather than individual interventions
- Target interventions attracting current policy attention, such as school-based health promotion and school-based physical activity programmes – where there is limited or a current lack of evidence supporting their implementation (see Tables)
- Include lower socio-economic, ethnic and vulnerable population groups in intervention studies to help address known inequalities
- Use high quality designs (for example RCTs) with adequate follow-up (at least one year), and include process/qualitative information to allow features of effective interventions to be easily identified, and to provide cost effectiveness data
- Include an assessment of the psychosocial impact of interventions by collecting qualitative data on the views of participants
- Investigate the long-term sustainability of interventions
- Consider the barriers to the translation of effective strategies from research settings to clinical practice.

In addition to the gaps noted above, this briefing has found a complete lack of evidence in the systematic

reviews and meta-analyses regarding the effectiveness of interventions targeting specific socio-economic, ethnic or vulnerable groups. This reflects the general dearth of evidence in relation to public health interventions that address health inequality issues. Also, while a number of effective interventions have been identified, there is no reported evidence on the cost effectiveness of these interventions.

## Intervention design

The authors of the HDA Evidence Base reviews have made the following recommendations for future intervention research (presented in no particular order):

- When undertaking evaluations of interventions, there is a need to collect, where possible, data relating to the psychological profile of patients using appropriate and validated measures (NHS CRD, 1997)
- Studies should be undertaken to identify the patient-related variables that are likely to predict the effectiveness of interventions (NHS CRD, 1997)
- Information concerning gender, ethnicity, socio-economic features and genetic profiles should be routinely gathered (NHS CRD, 1997)
- The benefit of targeting specific groups or applying a whole population approach should be investigated (NHS CRD, 1997; NIH, 1998)
- Data should be collected on those who have dropped out of interventions
- Researchers should investigate what aspects of interventions appear to be effective or ineffective (eg types of setting, sources of advice, frequency of contact)
- Consideration needs to be given to the timing and naming of intervention components to allow appropriate evaluation. For example, weight loss is usually complete within three to four months and a weight management phase follows. Different weight management methods may be appropriate, and it might be useful for future projects to analyse loss and maintenance phases separately.

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# Introduction

This briefing provides a review of the evidence about the management of obesity and overweight. These are conditions in which weight gain (predominantly fat) has reached the point of endangering health (see Body Mass Index in Glossary for definitions). The prevalence of overweight and obesity has increased rapidly over the past two decades in the developed world and it has been described by the World Health Organization as ‘a global epidemic’ (WHO, 1998).

The aims of this document are to:

- Identify all relevant systematic reviews, syntheses and meta-analyses
- Review these papers and highlight ‘what works’ to prevent and treat overweight and obesity, and maintain weight loss for all population groups
- Highlight conflicting evidence, gaps in the evidence and provide a steer for future research commissioning.

## The HDA Evidence Base

Decisions about policy and practice in the public sector are increasingly driven by consideration of the best available evidence. The process of drawing together, analysing and synthesising evidence from research is a central principle of evidence-based practice. Typically, the process of reviewing an area of practice or intervention will include the production of a systematic review of effectiveness, a meta-analysis or some other review-level synthesis and interpretation of evidence from research.

As more reviews and meta-analyses are carried out across the spectrum of public health, there is an increasing need to map the areas that they cover, assess their quality, and pull together any common findings about what works in

particular areas to improve health and reduce health inequalities. The task of keeping abreast of such large amounts of information is now too difficult for any one person. Systematic reviews are able to condense this large amount of information, via a structured method, into summary documents. Within public health nutrition there has been an historical reliance on consensus documents and literature reviews, and there is a general lack of systematic reviews. This appears to be changing due to the timely work of several institutions and individuals around the world.

The Health Development Agency (HDA) has taken on the task of mapping and synthesising the best available review-level evidence for the effectiveness of interventions to improve health and reduce health inequalities, across priority areas of public health. This evidence briefing is part of the first set of publications from the project. Mapping and synthesis of review-level data will enable practitioners and policy makers to view the aggregate strength of the evidence in key areas, see clearly where review-level evidence is lacking, and inform the development and commissioning of future research and reviews.

Evidence briefings are essentially reviews of reviews, analysing the strengths and weaknesses, identifying gaps in the evidence, analysing future primary and secondary research needs, and discussing the implications of findings for policy and practice. Each document has a free-standing summary that is published separately. The documents are also published on, and supported by the HDA website ([www.hda.nhs.uk/evidence](http://www.hda.nhs.uk/evidence)). The Evidence Base website contains the latest edition of this briefing and the authors recommend that readers refer to the Evidence Base website to ensure they have the latest version. Access to the original reviews on which these briefings are based can also be found on the Evidence

Base website, when they are available. Evidence briefings are designed to be accessed by a variety of users including those simply looking for headline findings, those wanting complete and detailed syntheses, and those who need to track back to the original primary and secondary sources.

Providing comprehensive, up-to-date syntheses of the literature available in reviews is the chosen first step in a process of building the public health evidence base. As our programme of work continues, we will turn our attention to bringing into our evidence briefings work that does not usually find its way into systematic reviews.

Presently a three-tier structure underpins the HDA's work to develop the public health evidence base.

- A Public Health Evidence Steering Group (PHESG) with membership drawn from universities, public health and research and development divisions of the Department of Health, other government departments, public health practitioners, representatives of research funding bodies, the Centre for Reviews and Dissemination, University of York, Cochrane and Campbell collaborations, the EPPI-Centre, Institute of Education, University of London, and other UK and WHO representatives. The group is chaired by a high-ranking official from the Department of Health on behalf of the Chief Medical Officer for England. This overarching group advises on the broad strategic direction of the HDA Evidence Base and has a remit to quality assure the processes developed by the HDA to construct the Evidence Base.
- For each topic area covered (eg accidental injuries and low birth weight), there is a reference group. These report to the PHESG, and consist of key academics, practitioners and officials with expertise in the area. Reference groups control the contents of the HDA Evidence Base and guide the production of evidence briefings.
- Finally, the HDA is working to establish a robust evaluation framework for the entire HDA Evidence Base project. This will include the formation of user panels, to guide and inform our priorities and work.

The next stage in the process is the development of practice advice, derived from the findings of the evidence-based briefings. This briefing does not contain advice or guidance for practice. Following the publication of this briefing, a similar process of mapping and

synthesis, informed and reviewed by practitioner and research experts, will take place, leading to the production of practice-based advice and publications. Evidence into practice requires gathering evidence from all sources and, mindful of resource constraints, combining it with political and social information to develop learning that would be passed on to practitioners. The HDA has piloted this process of evidence into practice in two topic areas (physical activity and the prevention of accidental injuries) within the 2002-2003 financial year (Kelly and Speller, 2003).

## Who is this briefing for?

This briefing is intended to inform policy and decision makers, NHS providers, public health physicians and other public health practitioners in the widest sense. Further work will be done to turn the summary of evidence presented here into advice for practice. The limitations of this briefing and the data on which it is based, and alternative sources of evidence that may be helpful to inform policy and practice, are set out below. This briefing does not draw on many other sources of evidence available, and as such, should not be used to provide specific advice for practice.

## What is effectiveness?

In this briefing we use the term to describe demonstrable, intended effects on (usually quantitative) outcomes. However, the term is not uncontested. First, while 'demonstrable' effects, in this context, usually imply those that are statistically significant, in some situations – particularly where interventions require careful, long-term evaluation, this may be an ambitious definition. Second, in the UK at least there are some tensions between different kinds of outcome measures, depending on the focus of the study.

The appraisal system that we have used (see the critical appraisal form, Appendix 2) favours reviews that have a transparent and replicable data search, methodology and analysis. This means that systematic reviews of effectiveness and meta-analyses tend to be rated highest (if they are well conducted) because of their clear methodology, relative to literature or other non-systematic reviews. This is not to say that literature reviews cannot be counted as strong evidence – where

review rationale, methodology and analytic techniques are clear, they are rated highly.

Note, however, that reviews are not always comparing the same thing – some reviews examine outcome data studies, others look at more prospective studies – so interpretation of what we have found is complicated by the state of the data pool. Equally, the reviews themselves sometimes make difficult or inappropriate comparisons between and across evaluation studies that examine different aspects of the problem.

## Obesity and overweight

The prevention and management of obesity and overweight has been a national governmental policy concern for a number of years. In 1992, the Department of Health (DH) published the cross-government Health of the Nation strategy (DH, 1992). This contained 27 targets related to the improvement of public health in England. Two of these targets were concerned with the fat content of the diet, and two others with the future prevalence of obesity for men and women. In 1999, a new cross-government strategy was introduced, *Saving Lives: Our Healthier Nation* (DH, 1999). This white paper focused on four main priority areas of ill health and premature death, including coronary heart disease and cancer. There are no specific objectives or targets in this new strategy to reduce or limit the increase in the prevalence of obesity, although it is recognised as an important risk factor for coronary heart disease and some cancers.

*The NHS Plan: A Plan for Investment, A Plan for Reform* (DH, 2000a) reinforces the importance of diet and nutrition to improve health and reduce health inequalities. The commitment is that by 2004, there will be local action to tackle obesity and physical inactivity, informed by advice on what works from the HDA. Following this, the *National Service Framework for Coronary Heart Disease* (NSF CHD) was published (DH, 2000b). This document sets national standards and defines service models for the prevention and treatment of coronary heart disease. The framework includes milestones on the delivery of local programmes of effective policies on reducing overweight and obesity, promoting healthy eating and increasing physical activity. *The NHS Cancer Plan* (DH, 2000c) recommends local action on obesity for improving cancer prevention.

Similarly, the *NSF for Diabetes* (DH, 2001) includes the prevention and reduction of overweight and obesity, including central obesity, to prevent Type 2 diabetes. The HDA has produced two guidance documents for the implementation of the preventive aspects of the NSF CHD and *The NHS Cancer Plan* (HDA, 2000, 2002). They provide advice on local strategies to reduce overweight and obesity.

In 2001, the National Audit Office (NAO) published its report *Tackling obesity in England* in which it scrutinised the effect of obesity on the nation. The report identified and measured the human costs of obesity and estimated the financial costs to the NHS and the wider English economy. It also assessed how the NHS was responding to the problem and examined how effectively different government departments were working together on this issue. The report has made a series of recommendations. Furthermore, the Public Accounts Committee has a statutory obligation to respond to the NAO report to describe the actions being undertaken by government to address the recommendations suggested in the report. This response was published in January 2002 and the relevant government departments have made a reply to the Public Accounts Committee.

*The Chief Medical Officer's Annual Report 2002* (DH, 2003) has highlighted obesity as 'the health time bomb' and recognises that obesity is a growing challenge for government as a whole. A number of actions have been recommended across many sectors including the food industry, leisure and sports industries, regional and local government, the health sector, drug companies and the Food Standards Agency.

The HDA has been tasked by the Department of Health to develop an evidence base of effective health improvement interventions. One of the topics chosen was obesity and overweight, and hence this briefing will join many other topic-based briefings on the Evidence Base website ([www.hda.nhs.uk/evidence](http://www.hda.nhs.uk/evidence)). This document will also be routinely updated when new evidence is available.

## Prevalence of obesity and overweight

Since 1980 the prevalence of obesity has nearly trebled in the UK and is continuing to increase. In 1980, eight per cent of adult women and six per cent of adult men were

classified as obese; by 2001 this had trebled to 23.5% of women and 21% of men. However, more men than women were in the overweight category (46.6% compared to 32.9%). Combining the overweight and obese groups, nearly two thirds of men and over half of women were either overweight or obese in 2001 (Joint Health Surveys Unit, 2002). Furthermore, data from the Health Survey for England (Joint Health Surveys Unit, 2002) also revealed that age, education, social class and prosperity have an important influence on the risk of becoming obese. Obesity has been shown to (NAO, 2001):

- Increase with age
- Increase most rapidly when people are in their twenties and early thirties
- Be more prevalent in the lower socio-economic and lower income groups; for example, obesity is higher in manual than in non-manual social groups and the social class gradient is particularly strong in women
- Have a higher prevalence among certain ethnic groups, in particular among African-Caribbean and Pakistani women (Joint Health Surveys Unit, 2001)
- Be a problem for all the regions across England but with some important regional variation.

The prevalence of obesity is also rising in children, regardless of the assessment method used. The Health Survey for England (Joint Health Surveys Unit on behalf of the Department of Health, 2002) reports that a considerable number of children are either overweight or obese – for example, in 2001 8.5% of 6 year olds and 15% of 15 year olds were obese. These findings were based on a body mass index (BMI) above the 95th percentile to represent obese and a BMI above the 85th percentile to represent overweight. The survey also showed that between 1996 and 2001 the proportion of overweight children (aged 6-15 years) increased by 7% and obese children by 3.5%. The findings of the 1997 National Diet and Nutrition Survey (NDNS) in British young people (4-18 years) also found that the prevalence of overweight has increased to 15.4% and that 4% of the young people surveyed were obese (Jebb et al., 2003). Furthermore, this survey found that inequalities in the prevalence of overweight and obesity also exist in children, with higher rates among Asian groups, lower social classes and children living in Wales and Scotland (Jebb et al., 2003). These findings were based on BMI calculations from measured height and weight data using international centile cut-off points for overweight and obesity (Cole et al., 2000). BMI changes substantially with

age: at birth the median is low but increases at age one, decreases at age six and then increases at age 20. Therefore, a cut-off point related to age was developed to define child obesity using reference centiles (Cole et al., 2000). The evidence linking obesity in childhood to an increased risk of adulthood obesity is strong (Parsons et al., 1999), and this has serious implications for the future prevalence of obesity in the adult population.

## Causes of obesity and overweight

The fundamental cause of obesity and overweight in an individual is an excess of energy intake over energy expenditure (WHO, 1998; NAO, 2001). However, this statement takes no account of the complexities involved with obesity causation, such as links to behavioural, environmental, social and genetic factors. These are discussed in many other texts (Jebb, 1997; WHO, 1998).

## Why is obesity important?

Obese people are more likely to suffer from a number of serious chronic diseases, many of which are life limiting. For example, in one study, having a BMI greater than 30 led to an average of seven years' life lost in comparison to a person with a healthy weight – and this held true for both women and men, smokers and non-smokers (Peeters et al., 2003). Besides the physical effects, there are also considerable psychological and social effects (see Table 1).

The consequences of childhood obesity are similar to those of adults and include (Scottish Intercollegiate Guidelines Network (SIGN), 2003):

- Hypertension
- Dyslipidaemia
- Adverse changes in left ventricular mass
- Hyperinsulinaemia
- Psychological consequences, ie poor self-esteem, being perceived as unattractive, depression, disordered eating, bulimia and body dissatisfaction
- Other medical consequences, ie risk of developing asthma and the exacerbation of pre-existing asthma, abnormalities of foot structure and function, and increased risk of Type 1 diabetes.

The most important long-term consequence of childhood obesity is its persistence into adulthood. Risk increases

**Table 1: Health risks associated with adult obesity (WHO, 1998)**

Greatly increased (Relative risk >>3)	Moderately increased (Relative risk 2–3)	Slightly increased (Relative risk 1–2)
Type 2 diabetes Gall bladder diseases Dyslipidaemia Metabolic syndrome Breathlessness Sleep apnoea	Coronary heart disease Hypertension Osteoarthritis (knees and hips) Hyperuricaemia and gout	Cancer (breast cancer in postmenopausal women, endometrial cancer, colon cancer) Reproductive hormone abnormalities Polycystic ovary syndrome Impaired fertility Low back pain Increased risk of anaesthetic complications Foetal defects associated with maternal obesity

with the age of the child and with the severity of the obesity.

The NAO (2001) found that obesity is a considerable burden to England economically. In 1998, its consequences included:

- Over 18 million days of sickness, costing £1,322 million in lost earnings
- Over 30,000 deaths in England (six per cent of all deaths that year)
- £480 million direct cost to the NHS (1.5% of total NHS expenditure)
- £2.1 billion indirect cost to the economy in terms of lost output due to sickness or death of workers
- A total estimated cost to England of £2.6 billion. If the prevalence of obesity continues to rise at the present rate until 2010, this annual cost would increase by £1 billion, or over a third, to around £3.6 billion.

An earlier study (Hughes et al., 1999) used a modified method of attributable risk to establish the full resource implications of treating obesity and its associated diseases for the NHS budget. This estimated the total costs of treating obesity and its related diseases at £355 million at 1995 prices, of which £3.8 million was the direct cost of treating obesity itself and £351 million was attributable to the costs arising from associated diseases. However, the authors noted that this was a conservative estimate, even for 1995.

## Benefits of the management of obesity and overweight

Weight loss in overweight and obese individuals improves physical, metabolic, endocrinological and psychological complications, often dramatically. Intentional weight loss may also reduce obesity-related mortality. The Scottish Intercollegiate Guidelines Network (SIGN, 1996) describes in more detail the many benefits that can derive from a modest weight loss (see Table 2).

**Table 2: The benefits of a 10 kilogramme weight loss**

Mortality	Over 20% fall in total mortality Over 30% fall in diabetes-related deaths Over 40% fall in obesity-related cancer deaths
Blood pressure (in hypertensive people)	Fall of 10 mmHg systolic Fall of 20 mmHg diastolic
Diabetes (in newly diagnosed people)	Fall of 50% in fasting glucose
Lipids	Fall of 10% total cholesterol Fall of 15% low density lipoprotein Fall of 30% triglycerides Increase of 8% high density lipoproteins
Other benefits	Improved lung function, and reduced back and joint pain, breathlessness, and frequency of sleep apnoea Improved insulin sensitivity and ovarian function when more than 5% weight loss occurs

## The complexity of obesity

The health and economic consequences described so far make it clear that obesity is a problem that must be seriously addressed. However, other social and health factors make obesity a complex and interesting issue for policy makers and people who manage the treatment of obesity.

A review of observational studies by Blair and Brodney (1999) concluded that active or fit people were protected from certain hazards (stroke, heart disease, high blood pressure, and diabetes) of being overweight or obese. It went on to say that people who are fit and fat are actually less likely to die than people who have a healthy weight but are not fit or active. Activity therefore can confer many other benefits above and beyond any possible impact on a person's weight. This concept is also reflected in the Roundtable Consensus Statement of the American College of Sports Medicine (Bouchard and Blair, 1999).

Similarly, the patient and the health professional can differ on what they consider 'success'. For example, the personal goal of the patient who wishes to conform to societal pressures for slimness may be at odds with the health improvement goals of the health professional (improved blood lipids, blood pressure etc, and subsequent decrease in disease risk). Medical opinion promotes the health improvement gained from a 10 kilogram (kg) or 10% weight loss. However, for the average obese person, achieving this level of weight loss is unlikely to satisfy their goal of slimness. Furthermore, dietary treatment advised by a health professional may not be acceptable to the patient. For example, a 1,500 kilocalorie diet, while not considered medically extreme, can be significantly lower than an obese person's normal intake (which can be 3,000 or more calories per day). Such a large decrease in caloric intake may be hard for people to accept. Moreover, sometimes the opposite is true where people insist that a 1500 kilocalorie diet is more than they normally eat.

Obesity is a disease of excess fat accumulation, and one of the aims of obesity and overweight management is to stop this process. The main focus is typically placed on weight loss, but weight stability is also highly relevant and important. Interventions that lead to no increase in weight over a period of time, in a world where weight gain is the norm, should also be considered successful.

With children, the options for managing obesity and overweight include no weight gain as height increases, or weight gain slower than height gain. Rapid weight loss and strict dieting are not appropriate for growing children unless under specialist care (Gibson et al., 2002).

The literature tends to confuse weight loss and weight maintenance interventions. Weight loss is usually a brief component (complete within three to four months), and studies longer than this period should be considered as a combination of weight loss with some degree of maintenance. These components should be evaluated separately. The papers examined in this review of reviews do not make this distinction.

The policies usually discussed for the treatment of obesity and overweight (for example, service provision, training and resources) are often very different from those put forward for prevention (for example, policies to encourage environmental change). Discussions about maintaining weight loss often include both.

This briefing describes interventions that work to prevent and treat obesity and overweight, and maintain any weight lost, from a health perspective focused solely on obesity and overweight. Policy makers must use both qualitative and quantitative information in context with many other sources of information from health, society and politics to determine a course of action to combat the epidemic of obesity. Evidence of effectiveness from systematic reviews and meta-analyses will be only one component of information considered within the policy decision-making process.

## Methodological issues

At present, the systematic review is probably perceived to be the most robust and reliable marker of effectiveness, closely followed by a well-designed meta-analysis. They are used heavily in clinical sciences to inform practice, and are generally well regarded when used appropriately. This evidence-based briefing pulls together evidence from systematic reviews of effectiveness, meta-analyses and narrative or literature reviews – a good spectrum of all the review-level evidence in the area. Yet relying on this type and level of evidence to inform our conclusions about the management of obesity and overweight has some limitations, and it is important to consider them when making decisions about policy or practice.

Definitions of what constitutes 'good' quality evidence in mainstream public health have been inherited from medical and scientific paradigms, where the experimental evaluation of clinical efficacy is commonplace and often appropriate. Although there is an increasing use of these approaches that rely on traditional evidence hierarchies, they may not always be the most appropriate methods of assessing the impact of interventions to improve public health, nor in particular to assess the impact of interventions on health inequalities.

At review (rather than single study) level, meta-analyses and systematic reviews of effectiveness can be very powerful tools for demonstrating the impact (or lack of it) of an intervention. However, they rely heavily on controlled evaluation studies, and statistically measurable outcome variables. In contrast, the management of obesity and overweight is highly complex and relational, and almost impossible to capture in terms of quantitative outcomes alone. Public health priorities often do not 'fit' easily into these types of study designs.

Systematic reviews within nutrition typically range far wider than assessment of randomised controlled trials (RCTs – see Glossary). Many of the reviews cited in this briefing include non-randomised controlled studies, quasi-experimental and observational studies (see Glossary). Within the field of public health nutrition RCTs are often difficult to design and may not be appropriate for the chosen intervention. This is particularly the case for 'upstream interventions' that try to influence national/regional strategies or policies, or the wider environment. We acknowledge the contributions of evidence collected using a wide range of methods. As Brunner et al. (2001) comment, 'What is important is that the evidence is collated systematically, with transparent inclusion and exclusion criteria, with attention paid to the methodological quality of the work, and without prior assumptions about the findings being allowed to influence what evidence is considered.'

A second issue is that, while meta-analyses and systematic reviews (and sometimes, to a lesser extent, literature reviews) are well placed to make judgements about the strength of impact of an intervention, and the quality of the evaluation design, they tend not to examine the appropriateness or quality of an intervention itself, and certainly not in any robust or systematic manner. This can be a source of bias – an inappropriate intervention might have a strong impact on one

quantifiable outcome measure, and therefore influence review conclusions, even though that outcome measure might not be the most appropriate or useful. In other words, there is a risk that inappropriate or ill-designed interventions can be given more weight than more suitable (and often more complex or long-term) interventions, because they may be simpler and quicker to evaluate, or because they can prove some effect relatively easily. However, in spite of these limitations systematic reviews are still a powerful tool in certain circumstances, based as they are on principles of finding good and effective interventions, eliminating harmful interventions, and facilitating public accountability – principles that are important cornerstones to building the public health evidence base.

A third issue is that reviews tend to rely on data from certain types of evaluation design – most often experimental and quasi-experimental trials – thus excluding a substantive amount of literature from their consideration. It is important to note that if this evidence briefing has uncovered no evidence to support a certain intervention or programme, it does not mean there is absolutely no evidence out there, just that we have found no evidence included in reviews that meet our criteria.

Also, sometimes when studies find an intervention has not been effective, this does not necessarily lead to a conclusion that the intervention, per se, is ineffective. For example, the study may not have had adequate power to detect a small positive difference, but ruling the intervention as ineffective is too judgemental, as future studies using the intervention, perhaps delivered by different individuals, may turn out to be effective. Certainly, 'closing doors' on interventions and labelling them as ineffective simply because of the small numbers of studies does not seem useful. In this briefing, such interventions are said to have a 'current lack of evidence', rather than being classed as 'ineffective'.

There is also a recognised methodological problem when undertaking a review of reviews – that different reviews frequently include some of the same primary evidence. This would bias findings in favour of study results which occur more often in the individual reviews.

Another issue to consider is the methodology of the systematic reviews themselves, on which this briefing is based. A number of authors have appraised systematic review methodology and have questioned many of its

underlying assumptions (Hammersley, 2001). One common criticism is publication bias:

- Papers that demonstrate effective outcomes are more likely to be submitted to journals
- Negative impacts may be omitted from papers
- 'Positive' papers are more likely to be published by journal editors
- 'Positive' papers are more likely to appear in systematic reviews
- Such papers are, therefore, more likely to appear in reviews of reviews.

At present there are problems in trying to incorporate other types of evidence into our evidence briefings. In some areas, such as qualitative research, the thresholds as to what constitutes 'good' quality work are contested by different researchers. There is as yet no agreed method for systematically synthesising or reviewing such work, although there are a number of projects underway nationally and internationally to develop an appropriate methodology. Nor is there any clear or agreed method for combining non-traditional forms of evidence – such as that from qualitative research, action research, expert opinion and so on – with evidence from more traditional types of study to provide a more comprehensive assessment of the effectiveness of different interventions. For the time being, the HDA has taken a first step to pull together evidence from systematic reviews, meta-analyses and good quality narrative reviews, with an acknowledgement that this limits our data pool and may provide only partial answers to our research questions.

A final issue is that of time lag. Inevitably, if one relies on review-level data to gather information about effectiveness, some time – usually one or more years – will elapse between the publication of single studies, the subsequent examination of these single studies by reviewers, and the publication of their reviews. Because of the processes involved in carrying out meaningful, high quality research, this is to some extent inevitable, and it can be argued that the procedures that cause this delay – the need for publications to be peer-reviewed, the need for a body of work to build up before it can be reviewed and examined – help avoid publication or positive bias in review findings. It means that the reviews taken into account by this briefing will include single studies with a cut-off date of at least one year before the most recent review. If a single study has been published in the meantime that alters common conceptions or consensus

about the management of obesity and overweight, it will take a while for the findings of that single study to filter into this forum. We expect to revise and update this briefing annually, which should ensure that new review data are included swiftly.

In summary, the data presented in this evidence-based briefing – data from reviews – are only a partial answer to 'what works' with respect to the management of obesity and overweight. In using this briefing to inform practice or policy making, there are a number of other sources of information and evidence that could usefully be considered. These include:

- Information from practice studies (eg practice databases, 'promising practice' case studies)
- Research studies that are often or usually excluded from systematic reviews and meta-analyses (eg definitive studies, non-controlled case studies, action research)
- Local data and project evaluations (local to your context and area)
- Expert and practitioner opinion
- Client opinion and experience.

Mapping, collating and making available data from these alternative sources will be a future priority for the HDA. In the meantime, the Public Health Electronic Library (PHeL –[www.phel.gov.uk](http://www.phel.gov.uk)) will be a good starting point for the practitioner or policy maker seeking to take these other types of evidence into account.

# Methodology

This briefing is based on findings from systematic reviews, meta-analyses and syntheses of lifestyle interventions to prevent and treat obesity and overweight and maintain weight loss. It does not assess the effectiveness of surgical or pharmacological treatments for obesity, as this work is the remit of the National Institute for Clinical Excellence (NICE). NICE has examined the effectiveness of orlistat, sibutramine and surgery for the treatment of obesity and has issued recommendations and clinical guidance. These can be found at [www.nice.org.uk](http://www.nice.org.uk). Furthermore, the HDA will be working in collaboration with NICE on the production of guidance for obesity identification, prevention and treatment, and maintenance of weight loss. This guidance will also draw on other existing guidance – for example, that produced by SIGN (2003), and by Gibson et al. (2002) for the Royal College of Paediatrics and Child Health and the National Obesity Forum.

This briefing is a 'review of reviews', that is, a synthesis of systematic reviews, meta-analyses and other syntheses, known as secondary data sources, as they have collated and interpreted original studies (primary data), and provided an interpretive overview of the collated findings. The primary data were typically derived from RCTs; however, where there was a lack of RCT research, findings were elicited from other studies such as non-RCT, quasi-experimental or observation studies. This synthesis is not a systematic review of primary data. In addition, we have not conducted a systematic search for practice data ('good' or 'best' practice studies) or grey literature. Again, this is not to discount the validity of such data – we believe they have an important place in the process of gathering evidence for making decisions about effective practice. However, tools enabling such data to be systematically searched and rated in an appropriate and sensitive way are yet to be fully developed.

## Identification of the relevant literature

An extensive and systematic search of the literature was conducted. The search strategy was devised in collaboration with the Centre for Reviews and Dissemination, University of York (an example of a search strategy is shown in Appendix 1). Searches were conducted on the following electronic databases:

Cochrane Library  
DARE database (further details available from <http://agatha.york.ac.uk/faq2.htm>)  
'Wider Public Health' report  
MEDLINE  
TRIP  
HTA  
SIGN  
Health Evidence Bulletins Wales  
National Guidelines Clearinghouse  
NCCHTA website  
NICE website  
REFER  
National Research Register  
Clinical Evidence  
EMBASE  
Sociological abstracts  
PsycINFO  
EPPI-Centre, Institute of Education, University of London  
Department of Health website  
Psychological abstracts  
Campbell  
PsycLit  
Cinahl  
Sociofile  
Social science citation index

All databases were searched from January 1996 to October 2002, an arbitrary choice to make the analyses

manageable. The searches generated 3,200 references. All citations were downloaded into Reference Manager software. In addition, 57 references from a search strategy conducted by Dr Alison Avenall, Health Services Research Unit, University of Aberdeen Medical School, were kindly donated.

## Data handling process

Titles and abstracts of identified references were independently assessed for relevance by two authors (C. Mulvihill and R. Quigley). The following inclusion criteria were used:

- English language only
- 1996 to October 2002
- Human studies
- Systematic reviews, syntheses and meta-analyses
- Lifestyle interventions to prevent, treat and manage overweight, obesity or distributional fat loss
- Lifestyle interventions to reduce intra-abdominal fat (waist-to-hip ratio, waist circumference or skinfold thickness – see Glossary).

Abstracts were rejected if the intervention included surgical or pharmacological components, as these interventions are within the remit of NICE. Similarly, systematic reviews of interventions promoting healthy eating and physical activity in the general population (Hillsdon et al., 2002; Roe et al., 1997) were excluded because they did not explicitly have weight reduction or weight maintenance as a stated objective. This ensured that the data handling process remained focused on its stated aims and objectives. Although many factors impact on overweight and obesity, successful interventions that target these factors may not lead to a reduction in body weight (as this is often not the aim of the intervention). However, we do recognise that this focus on weight loss is at the expense of other health indicators such as muscle mass, blood lipid values, fitness and dietary habits. Unfortunately these benefits have not been acknowledged in the HDA Evidence Base statements and have only been discussed in the introduction.

Where no clear decision could be made on the basis of the title or abstract, studies were considered relevant. Reference lists of all retrieved papers were also searched to identify further papers. From both processes a total of 163 papers thought to be relevant were ordered from the British Library and all papers were retrieved.

All papers were assessed independently by two authors (C. Mulvihill and R. Quigley) and critically appraised in terms of transparency, systematicity and relevance according to HDA Evidence Base methodology. There was no blinding of authorship of retrieved papers. Any queries regarding the methodology of the review or meta-analysis were followed up with the authors of the original papers. A critical appraisal form was completed by each reviewer (Appendix 2) and a joint decision was made about whether a paper should be included on the HDA Evidence Base, used in the briefing to inform discussion, or discarded. Disagreements were resolved through discussion, or, if necessary, by recourse to a third reviewer (Dr Carolyn Summerbell).

The Evidence Base papers were compared and findings collated. Evidence was classified by prevention, treatment and maintenance and by the type of intervention, population group or setting. Conflicting evidence was identified and gaps in the evidence base were charted. Within each section, we make a number of summary statements about whether certain interventions were effective, based on the evidence from the included Evidence Base papers. Each summary statement categorises the evidence as follows:

- **Evidence of effectiveness:** derived from systematic reviews and meta-analyses which included four studies or more, where the results were all in agreement
- **Limited evidence of effectiveness:** derived from systematic reviews and meta-analyses that included three studies or less
- **Lack of evidence of effectiveness:** applied to interventions in systematic reviews and meta-analyses which showed no current impact on obesity and overweight outcomes
- **Conflicting or inconclusive evidence:** derived from systematic reviews and meta-analyses where the interpretation and conclusions of the papers were not in agreement.

# Evidence Base papers

The following systematic reviews and meta-analyses met the criteria outlined in the Methodology section and were included onto the HDA Evidence Base, which can be viewed at [www.hda.nhs.uk/evidence](http://www.hda.nhs.uk/evidence)

Astrup, A., Grunwald, G. K., Melanson, E. L., Saris, W. H. M. and Hill, J. O. (2000). The role of low-fat diets in body weight control: a meta-analysis of ad libitum dietary intervention studies. *International Journal of Obesity* 24: 1545-52.

Campbell, K., Water, E., O'Meara, S. and Summerbell, C. (2001). Interventions for preventing obesity in children (Cochrane Review). In: *The Cochrane Library*, Issue 2. Oxford: Update Software.

Douketis, J. D., Feightner, J. W., Attia, J., Feldman, W. F. with the Canadian Task Force on Preventative Health Care. (1999). Periodic health examination, 1999 update: 1. Detection, prevention and treatment of obesity. *Canadian Medical Association Journal* 160: 513-25.

Fogelholm, M. and Kukkonen-Harjula, K. (2000). Does physical activity prevent weight gain – a systematic review. *Obesity Reviews* 1: 95-111.

Hardeman, W., Griffin, S., Johnston, M., Kinmonth, A. L. and Wareham, N. J. (2000). Interventions to prevent weight gain: a systematic review of psychological models and behaviour change methods. *International Journal of Obesity* 24: 131-43.

Harvey, E. L., Glenny, A-M., Kirk, S. F. L. and Summerbell, C. D. (2001). Improving health professionals' management and the organisation of care for overweight and obese people (Cochrane Review). In: *The Cochrane Library*, Issue 2. Oxford: Update Software.

Henrikus, D. J. and Jeffery, R. W. (1996). Worksite intervention for weight control: A review of the literature. *American Journal of Health Promotion* 10: 471-98.

LeMura, L. M. and Maziekas, M. T. (2002). Factors that alter body fat, body mass, and fat-free mass in pediatric obesity. *Medicine and Science in Sports and Exercise* 34: 487-96.

National Heart, Lung and Blood Institute (NIH) (1998). *Clinical guidelines on the identification, evaluation and treatment of overweight and obesity in adults. The Evidence report*. Bethesda, Maryland: National Institutes of Health.

NHS Centre for Reviews and Dissemination (1997). *A systematic review of the interventions for the prevention and treatment of obesity, and the maintenance of weight loss*. CRD Report 10, University of York.

NHS Centre for Reviews and Dissemination (2002). *The prevention and treatment of childhood obesity. Effective Health Care* 7 (6).

Pirozzo, S., Summerbell, C., Cameron, C. and Glasziou, P. (2002). Advice on low-fat diets for obesity (Cochrane Review). In: *The Cochrane Library*, Issue 3. Oxford: Update Software.

Shephard, R. J. (1996). Worksite fitness and exercise programs: A review of methodology and health impact. *American Journal of Health Promotion* 10: 436-52.

The identified papers differed in methodology and inclusion criteria for studies (Table 3). This had implications for the reported evidence of effectiveness of interventions between papers, and will be discussed in greater detail later on. The papers also investigated a range of interventions and age groups, as shown in Table 4. Sometimes, we have used information from supplementary papers to add further insights to our summary statements to consider why or how certain interventions are effective. However, supplementary papers do not form the basis of our summary statements – the analysis and synthesis of the evidence is based on HDA Evidence Base papers alone.

It is important to note that popular forms of self-weight management, ie commercial weight loss organisations, diet books and magazines and over-the-counter slimming products, have not been systematically reviewed and are therefore not included in this review of reviews (see 'Gaps in the evidence base'). However, we acknowledge the popularity of these methods and would encourage their evaluation as an important contribution to the evidence base. Furthermore, the HDA Evidence Base papers did not consider or assess the psychosocial impact of obesity and overweight interventions, except for school-based interventions (see 'Gaps in the evidence base').

The findings are organised into categories principally defined by the evidence base papers, ie population groups, intervention type and settings. However, it is recognised that in reality a combination of approaches would be used in the management of obesity and overweight rather than isolated interventions. The emphasis placed on each component depends on the skills of the practitioner, and the characteristics (both physical and psychological) and circumstances of the target individual or group.

**Table 3: Methodology of reviews and meta-analyses included onto the HDA Evidence Base**

Author and year	Title of paper, number and type of studies included	Observation/ follow-up period	Transparency and systematicity – Details included			Results of individual studies
			Databases and years searched	Search strategy	Study inclusion criteria	
Astrup et al. (2000)	The role of low-fat diets in body weight control: a meta-analysis of ad libitum dietary intervention studies. 19 controlled studies (14 RCTs)	More than 2 months	✓	✓	✓	✓
Campbell et al. (2001)	Interventions for preventing obesity in children. 7 studies (RCTs and non-RCTs)	Minimum 3 months	✓	✓	✓	✓
Douketis et al. (1999)	Periodic health examination, 1999 update: 1. Detection, prevention and treatment of obesity. 39 studies (RCT and prospective cohort studies)	2 years	✓	✓	✓	✓
Fogelholm and Kukkonen-Harjula (2000)	Does physical activity prevent weight gain – a systematic review. 46 studies (prospective, observation studies, RCTs and non-RCTs)	Prospective, observational studies – 2 years RCT and non-RCT – 1 year	✓	✓	✓	✓
Hardeman et al. (2000)	Interventions to prevent weight gain: a systematic review of psychological models and behaviour change methods. 9 studies included regardless of design	No information	✓	✓	✓	✓
Harvey et al. (2001)	Improving health professionals' management and the organisation of care for overweight and obese people. 18 studies (RCTs, controlled before-and-after studies, interrupted time series designs)	No information	✓	✓	✓	✓
Hennrikus and Jeffery (1996)	Worksite intervention for weight control: A review of the literature. 42 studies (RCTs, non-RCTs, pre-and-post studies)	No information	✓	✓	✓	✓

**Table 3: Methodology of reviews and meta-analyses included onto the HDA Evidence Base (cont.)**

Author and year	Title of paper, number and type of studies included	Observation/ follow-up period	Transparency and systematicity – Details included				Results of individual studies
			Databases and years searched	Search strategy	Study inclusion criteria	Assessment of quality of studies	
LeMura and Mazieckas (2002)	Factors that alter body fat, body mass, and fat-free mass in pediatric obesity. 30 studies (RCTs, non-RCTs, observational studies)	3 weeks or more	✓	✓	✓	✓	✓
NHS CRD (1997)	A systematic review of the interventions for the prevention and treatment of obesity, and the maintenance of weight loss. 99 studies (97 RCTs)	At least 1 year	✓	✓	✓	✓	✓
NHS CRD (2002)	The prevention and treatment of childhood obesity. 25 studies (all RCTs)	No information	✓			✓	✓
NIH (1998)	Clinical guidelines on the identification, evaluation and treatment of overweight and obesity in adults. 236 studies (RCTs, non-RCTs, observational studies)	At least 4 months	✓		✓	✓	✓
Pirozzo et al. (2002)	Advice on low-fat diets for obesity. 6 studies (all RCTs)	At least 6 months	✓	✓	✓	✓	✓
Shephard (1996)	Worksite fitness and exercise programs: A review of methodology and health impact. 51 studies (RCTs, quasi-experimental and other studies)	No information	✓			✓	✓

**Table 4: Interventions investigated by reviews and meta-analyses included onto the HDA Evidence Base**

Author and year	Intervention type, age group and setting															
	Prevention (children)		Treatment (children)	Prevention (adults)	Treatment (adults)						Maintenance (adults)			Settings		
				Diet	Physical activity	Diet and physical activity	Behavioural therapy	Reduce intra-abdominal fat	Maintenance of weight loss	Comprehensive (treatment & maintenance)	Work site	Healthcare	Health professionals			
Astrup et al. (2000)				✓												
Campbell et al. (2001)	✓															
Douketis et al. (1999)			✓				✓									
Fogelholm and Kukkonen-Harjula (2000)									✓							
Hardeman et al. (2000)	✓															
Harvey et al. (2001)															✓	✓
Hennrikus and Jeffery (1996)															✓	
LeMura and Mazekas (2002)			✓													
NHS CRD (1997)	✓		✓	✓			✓		✓					✓		
NHS CRD (2002)	✓		✓													
NIH (1998)				✓	✓		✓	✓							✓	
Pirotto et al. (2002)				✓												
Shephard (1996)															✓	

# Evidence

## Prevention of obesity and overweight in children

Four systematic reviews have investigated the prevention of obesity and overweight in children (Campbell et al., 2001; NHS CRD, 1997; Hardeman et al., 2000; NHS CRD, 2002). Since the NHS CRD (2002) review has superseded NHS CRD (1997), the following discussion does not include findings from the 1997 review.

A Cochrane review (Campbell et al., 2001) examined seven studies (RCTs and non-randomised trials with concurrent control group), three long term and four short term. Most studies were carried out in the USA with children aged 7-12 years with small sample sizes. The authors found the most promising intervention (two studies in US schoolchildren) to be a simple reduction in sedentary behaviours, although there is a need for further well-designed studies in this area. The limited data made it difficult for the authors to conclude whether one strategy or a combination of strategies was more important than any other strategy in preventing obesity and overweight. They concluded that 'currently there is limited quality data on the effectiveness of obesity prevention programmes and as such, no generalisable conclusions can be drawn. The mismatch between the prevalence and significance of the condition and the knowledge base from which to inform preventative activity, is remarkable and an outstanding feature of this review.'

A systematic review of interventions to prevent weight gain in both children and adults (Hardeman et al., 2000) identified five distinct interventions in schools and two that investigated mother and daughter pairs. Despite the inclusion of children in their analysis, there were no reported findings or conclusions specific to children. Therefore this systematic review is discussed in the

section on prevention of obesity and overweight in adults.

A more recent analysis of obesity and overweight prevention in children (NHS CRD, 2002) identified nine RCTs, four of which were also included in Campbell et al. (2001). As this systematic review identified a greater number of studies, the findings and HDA Evidence Base statements are presented according to the study setting and type of intervention as organised within this systematic review.

### School-based health promotion programme

One school-based RCT used a classroom curriculum to reduce television, videotape and video game use among children aged 8-9 years. At seven months follow-up, children in the intervention group watched significantly less television and played fewer video games than the control group. There was also a statistically significant decrease in BMI, waist circumference, waist-to-hip ratio and tricep skinfold thickness compared with the control group.

**Currently, there is limited\* evidence to support school-based health promotion (classroom curriculum to reduce television, videotape and video game use) for the prevention of obesity and overweight in children.**

### School-based physical activity programmes

Two school-based physical activity programmes, one carried out on kindergarten-aged children and one on primary school-aged children, led by specialist staff or

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\* Limited is arbitrarily defined as three studies or less.

classroom teachers suggested that active programmes of physical activity are not enough to reduce levels of obesity and overweight in children.

Currently, there is a lack of evidence of effectiveness for school-based physical activity programmes led by specialist staff or classroom teachers for the prevention of obesity and overweight in children.

## School-based multi-faceted interventions

Five multi-faceted interventions were identified, typically containing the following components: nutrition education, physical activity promotion, reduction in sedentary behaviour, behavioural therapy, teacher training, curricular material, and modification of school meals and tuck shops. The review concluded that multi-faceted interventions 'may help to reduce obesity in schoolchildren, particularly girls'.

There is evidence to support the use of multi-faceted school-based interventions to reduce obesity in schoolchildren, particularly girls. These interventions included nutrition education, physical activity promotion, reduction in sedentary behaviour, behavioural therapy, teacher training, curricular material, and modification of school meals and tuck shops.

## Family-based health promotion interventions

Family-based interventions (two RCTs) with a strong focus on dietary and general health education and increased activity, involving sustained contact with children and parents, influenced dietary habits but did not clearly impact on weight.

Currently, there is a lack of evidence that family-based health promotion interventions impact on obesity and overweight. These interventions had a strong focus on dietary and general health education and increased activity, and involved sustained contact with children and parents.

## Family-based behaviour modification programmes

One study carried out in Sweden was identified (NHS CRD, 1997; 2002), which reported that family therapy sessions, as an adjunct to conventional treatment, prevented the progression of severe obesity in already obese children (BMI greater than 23). The targeted group was Swedish children aged 10-11 years, and the family therapy comprised six sessions over six months, in addition to conventional treatment (diet education, regular visits to a paediatrician, encouragement to exercise). At 12 month follow-up, the children receiving family therapy as an adjunct to conventional treatment had a significantly smaller increase in BMI scores compared with the untreated control group. This research should be replicated in other age groups and settings using larger sample sizes.

Currently, there is limited\* evidence that family-based behaviour modification programmes impede weight gain in obese children. These programmes provide family therapy in addition to diet education, regular visits to a paediatrician and encouragement to exercise.

## Treatment of obesity and overweight in children

Three systematic reviews were included onto the HDA Evidence Base for the treatment of obesity and overweight in children (NHS CRD, 1997; NHS CRD, 2002; LeMura and Maziekas, 2002). Two non-systematic reviews were also identified. The findings of Epstein and Goldfield (1999) presented conflicting data from six studies, of which three demonstrated significant improvements in weight loss from diet (800-1,200 kilocalories per day or nutrition classes) plus exercise groups, while the remaining three (diet alone and no other intervention) did not. In a meta-analysis of the six studies, an overall modest weight loss for the diet plus exercise groups was calculated. The review by Jelalian and Saelens (1999) investigated the efficacy of interventions for paediatric obesity from a psychological perspective. However, despite the title of this review, the scope and conclusions were similar to that of NHS CRD (1997). As these two reviews were not accepted for inclusion onto the HDA Evidence Base, our conclusions are based on the findings of the NHS CRD (1997 and 2002) systematic reviews.

## Targeting parents and children together (family-based physical activity and health promotion interventions)

Two systematic reviews covered this topic (NHS CRD, 1997 and 2002). The targeting of parents and children (aged 6-12 years) together for weight loss showed a statistically significant benefit, when compared to targeting children alone, at five year follow-up (four studies in NHS CRD, 1997). However, insufficient data were presented on sample size and baseline characteristics to draw firm conclusions.

NHS CRD (2002) covered the same topic, but included two later studies (six studies in total, five carried out by the same research group). All six studies involved the participation of at least one parent in physical activity and health promotion. This review concluded that 'there is some evidence that family-based programmes which actively increase physical activity, provide dietary education and target reductions in sedentary behaviour may help children lose weight.'

It is also important to note that the four studies included in the NHS CRD (1997) review and five studies in the 2002 review were conducted by the same North American research group. There is therefore a need to replicate this research more widely, especially in a non-USA setting.

**There is evidence that targeting parents and children together (in family-based interventions, involving at least one parent with physical activity and health promotion) is effective in treating obesity and overweight in children.**

## Family-based programmes with parents as agents of change

The NHS CRD (2002) review identified six RCTs where parents took primary responsibility and acted as agents for behaviour change. Five of these were also included in the NHS CRD (1997) review but interventions were analysed in terms of 'targeting parents and children together', 'the role of parental involvement in the treatment of their child' and 'lifestyle changes'. These interventions were typically multi-component, comprising diet, exercise, reducing sedentary behaviour and lifestyle counselling, with training in child management, parenting

and communication skills. Findings showed some evidence that these multi-faceted programmes may help children of primary school age lose weight. The NHS CRD (1997) review reinforced this conclusion, noting that the value of parental involvement may vary according to the age of the children, and parental involvement may be more beneficial for younger children (5-8 years). The authors suggest that adolescents are generally less likely to comply with their parents' wishes, a tendency which could affect the outcome and subsequent effectiveness of family-based obesity interventions.

**There is evidence to support the use of multi-faceted family-based behaviour modification programmes, where parents take primary responsibility for behaviour change, in the treatment of obesity and overweight in primary schoolchildren. Programmes comprised diet, exercise, reducing sedentary behaviour and lifestyle counselling, with training in child management, parenting and communication skills.**

## Family-based behaviour modification programmes

The NHS CRD (2002) review identified ten RCTs that evaluated family-based modification programmes. Of these, one was analysed in the NHS CRD (1997) review under the heading 'the role of parental involvement', and a second was included as an obesity prevention intervention. These programmes included behaviour modification, dietary and exercise education, with a mix of sessions involving the child, parent(s) and, in some cases, the entire family. The review concluded that while some findings appear promising, the small size of some of the studies and the disparate nature of the interventions mean there is 'at present insufficient evidence to recommend any specific programme'.

**Currently, there is a lack of evidence for family-based behaviour modification programmes for the treatment of childhood obesity. Programmes included behaviour modification and dietary and exercise education, with a mix of sessions involving the child, parent(s) and sometimes the entire family. At present there is insufficient evidence to recommend any specific programme.**

## Behaviour modification programmes with no parental involvement

The NHS CRD (2002) review identified only one RCT that involved overweight children (aged 9-19 years) with no parental involvement. This compared a three-part cognitive-behavioural 'obesity-training' programme combined with a calorie-reduced diet and an exercise programme, against a group that received the same diet and exercise component but received muscle relaxation training instead of the psychological component. The intervention lasted for six weeks. Both groups significantly reduced their percentage overweight over the course of a year. No statistically significant differences were found between the two treatment groups.

Currently, there is limited\* evidence that behaviour modification programmes with no parental involvement are effective in the treatment of childhood obesity. These programmes included a reduced calorie diet and an exercise programme, combined with cognitive-behavioural 'obesity-training', or muscle relaxation training.

## Exercise treatment programmes (within a laboratory setting)

A meta-analysis of 30 exercise treatment programmes for obese children and adolescents (LeMura and Maziekas, 2002) was undertaken to quantify the effects on body mass, fat-free mass and body fat. These programmes were largely experimental by nature, and included walking, jogging, cycle ergometry, high-repetition resistance exercise and combinations within a laboratory setting, as opposed to free-living lifestyle activity interventions. Due to the nature of the individual programmes, the analysis grouped all ages (5-17 years) and both genders together. Across all designs and categories, fixed effects modelling yielded significant decreases in the following dependent variables: percent body fat (mean =  $0.70 \pm 0.35$ ; 95% confidence interval (CI) = 0.21 to 1.1), fat-free mass (mean =  $0.50 \pm 0.38$ ; 95% CI = 0.03 to 0.57), body mass (mean =  $0.34 \pm 0.18$ ; 95% CI = 0.01 to 0.46) and BMI (mean =  $0.76 \pm 0.55$ ; 95% CI = 0.24 to 1.7). A stepwise linear regression found that the major predictors of change in body composition were pre-intervention percent body fat, exercise intensity, exercise mode (aerobic plus

resistance exercise) and type of intervention (ie exercise plus behaviour modification). The research synthesis demonstrated the effectiveness of exercise treatment programmes in an experimental setting when used in conjunction with other methods. The most favourable alterations in body composition occurred with low intensity, long duration exercise; aerobic exercise combined with high-repetition resistance training; and exercise programmes combined with a behavioural modification component.

There is evidence supporting the use of laboratory-based exercise programmes in the treatment of childhood obesity. These programmes consisted of walking, jogging, cycle ergometry, high-repetition resistance exercise and combinations within a laboratory setting, as opposed to free-living lifestyle activity interventions.

## Prevention of obesity and overweight in adults

Three reviews have investigated the prevention of obesity and overweight in adults (NHS CRD, 1997; Douketis et al., 1999; Hardeman et al., 2000). NHS CRD (1997) and Douketis et al. (1999) looked at the same three community-based studies, but there was a subtle difference in their conclusions. NHS CRD (1997) stated that 'community-based education programmes linked with financial incentives may be effective (based on one study) but more research is required', whereas Douketis et al. (1999) concluded that based on the very limited evidence to date, 'community-based obesity prevention methods have not been proven effective. There is insufficient evidence to recommend in favour of, or against, community-based obesity prevention programmes.' In all the studies, the mean weight of the intervention and control communities did not differ significantly during a three to seven year follow-up period. However, Douketis et al. (1999) also concluded that given the health risks and financial costs associated with obesity, priority should be given to the prevention of obesity over weight loss interventions.

A systematic review of interventions to prevent weight gain in both children and adults (Hardeman et al., 2000) identified 11 papers describing five distinct interventions in schools and four in the wider community. Five of the

\* Limited is arbitrarily defined as three studies or less.

studies were RCTs and half targeted individuals with a low income or a socially disadvantaged background. All the studies had a follow-up of at least one year, except one which followed up after six weeks. Due to the variability of study designs, samples and outcome variables, the authors found it difficult to identify effective types of interventions. The review reported positive changes in half of the interventions that measured diet and physical activity by self-report. Effects on observed weight were mixed, with two studies finding no significant differences, two studies reporting less weight gain in the intervention group and one study finding less weight gain only in sub-groups; the other four studies did not report on the effect on weight. Only one of the five RCTs reported a significant effect on weight. This intervention involved a correspondence programme and a mix of behaviour change methods including goal setting, self-monitoring and contingencies. Overall, the authors concluded that 'future interventions might be more effective if they were explicitly based on methods of behaviour change that have been shown to work in other contexts. Effective interventions would be more easily replicated if they were explicitly described. Effectiveness might be more precisely demonstrated if more objective measures of physical activity and diet were used, and if the follow-up was over a longer period.'

In summary, the evidence from the three identified reviews was found to be mixed and inconclusive in terms of effectiveness. Considering the potential scale of obesity and overweight and the associated health, economic and social consequences, the development of effective strategies to prevent obesity is a priority. Therefore, as with the prevention of obesity and overweight in children, there is an urgent need for further research.

**There is inconclusive evidence regarding the effectiveness of community-based interventions (for example, seminars, mailed educational packages and mass media participation) for the prevention of obesity and overweight in adults.**

## Treatment of obesity and overweight in adults

### Dietary intervention

There is a large quantity of evidence on the effectiveness of dietary interventions for the treatment of obesity and overweight. The most common dietary interventions are low calorie diets, very low calorie diets and low fat diets (see Glossary).

#### Low calorie diets (1,000-1,500 kilocalories per day)

The NIH (1998) report identified 34 RCT studies and found that regardless of the length of the intervention, low calorie diets (LCDs) result in weight reduction. From 25 RCTs varying in duration from six months to one year, LCDs produced a mean weight loss of approximately eight per cent body weight compared with controls. Four studies that included a long-term weight loss and maintenance intervention (three to four-and-a-half years) report an average weight loss of four percent over the period. However, since the NIH (1998) review contains a mix of short- and long-term studies (some lasting as little as four months), these positive findings should be treated with caution. Maintenance of long-term weight loss following LCDs is worth further investigation.

**There is evidence to support the effectiveness of low calorie diets (1,000-1,500 kilocalories per day) for the treatment of obesity and overweight in adults.**

#### Clinically prescribed very low calorie diets (400-500 kilocalories per day)

Two reviews were identified which examined the relative effectiveness of clinically prescribed very low calorie diets (VLCDs), usually in combination with behavioural therapy (see Glossary), against other interventions. While these reviews were concerned with relative effectiveness, they also demonstrated that clinically prescribed VLCDs were an effective intervention in their own right. The NIH (1998) report found that VLCDs either alone, or more often combined with behavioural therapy, promoted weight loss of approximately 13-23kg during the active

phase of the intervention, compared to 9-13kg with low calorie diets (based on four studies). The report concluded that 'VLCDs produce greater initial weight loss than LCDs. However, the long-term (>1 year) weight loss was not different from that of the LCDs.' In comparison, the NHS CRD (1997) review also examined two of the studies included in the NIH report, but while reporting the same findings, the authors were less clear about the relative effectiveness of VLCDs versus LCDs combined with behavioural therapy. They concluded that 'the effect of providing maintenance following an initial weight loss programme consisting of both VLCD and behavioural therapy needs to be studied'. This disparity may be due to the different inclusion criteria for studies in these reviews (Table 3).

The NHS CRD (1997) review discussed comprehensive interventions (where treatment and maintenance phases are combined) and concluded that there was no evidence to suggest that the use of a low calorie diet was more effective than a very low calorie diet when followed by the same maintenance programme (one study). It is important to note that the HDA Evidence Base papers did not consider the effectiveness of self-managed VLCDs or over-the-counter products.

**There is evidence to suggest that clinically prescribed very low calorie diets (400-500 kilocalories per day) are more effective for acute weight loss than low calorie diets. However, there is conflicting evidence regarding the relative effectiveness of very low calorie diets versus low calorie diets over the long term (more than one year).**

## Low fat diets

Three systematic reviews and a meta-analysis investigated the effectiveness of low fat diets (see Glossary) (NHS CRD, 1997; NIH 1998; Astrup et al., 2000; Pirozzo et al., 2002). While demonstrating that a low fat diet combined with energy restriction (ie a low calorie diet), and a low fat diet alone, were effective interventions in their own right, these reviews were also concerned with their relative effectiveness.

The NHS CRD (1997) review identified two studies which found that restricting fat and energy produced a statistically significant greater weight loss than restricting

fat alone. However, this significant effect was lost in the longer term (at one year follow-up). Therefore this review showed no evidence of any difference in effectiveness between fat and energy restriction combined versus fat restriction alone. In other words, there is no difference between a low fat, and a low fat and low energy diet.

A recent Cochrane review (Pirozzo et al., 2002) assessed the effects of low fat diets (providing up to 30% of calories from total fat) versus other weight-reducing diets. Only RCTs conducted on free-living overweight or obese subjects (BMI greater than 25) with a follow-up period of at least six months were included. Six studies met these inclusion criteria and found no significant difference in weight loss between the two groups at 6, 12 and 18 month follow-up. There was also no significant difference in BMI, percent body fat or waist-to-hip ratio at follow-up. The reviewers suggest that 'fat-restricted diets are no better than calorie-restricted diets in achieving long-term weight loss in overweight and obese people. Overall, participants lost slightly more weight on the control diets, but this was not significantly different from the weight loss achieved through dietary fat restriction and was so small as to be clinically insignificant.'

In comparison, the NIH (1998) report (based on nine studies) states that restricting fat alone (diets with 20-30% energy from fat) helps promote weight loss by producing a reduced calorie intake. Furthermore, restricting fat and energy together produces a greater weight loss. The authors conclude that there is little evidence that low fat diets (per se) cause weight loss independent of energy reduction. These conflicting conclusions are likely to be due to the differing inclusion criteria for studies in the two reports. The NIH report accepted studies lasting four months or more, compared with the NHS CRD review that only included studies of 12 months or more (see Table 3). The NHS CRD review noted a short-term impact, but no impact in the long term (more than 12 months).

On a similar, but not identical point, Astrup et al. (2000) carried out a meta-analysis of 19 controlled trials of ad libitum (see Glossary) low fat diets versus habitual diet/medium fat ad libitum diets lasting 2 to 12 months. A reduction in dietary energy from fat was significantly associated with a spontaneous weight loss of 3.2kg more in the intervention group compared with the control group. Weight loss was dependent on the pre-treatment body weight – the heavier the participant, the more

weight was lost. However, no trials involving groups of subjects with a BMI greater than 30 fulfilled the inclusion criteria, so the authors did not draw any conclusions for obese subjects. The differing conclusion between Astrup et al. (2000) and NHS CRD (1997) is likely to be due to differences in inclusion criteria. Astrup and colleagues compared only ad libitum diets, differing in fat content, whereas the NHS CRD compared ad libitum low fat diets with energy restricted diets.

Despite the popular perception that diets combining low fat and energy restriction are more effective for losing weight than low fat diets alone, the systematic review evidence is conflicting.

**There is evidence that diets combining low fat and energy restriction, and low fat diets alone (30% or less of total daily energy derived from fat) are effective at treating obesity and overweight in adults. However, there is conflicting evidence regarding their relative effectiveness.**

## Dietary fibre

The NHS CRD (1997) review examined the effectiveness of dietary fibre for the treatment of adult obesity. Based on two studies, its findings were conflicting. The role of fibre in weight control needs to be clarified. There is also a need to investigate the most appropriate method of providing fibre (by conventional foods or by supplement), and the duration of the intervention.

**There is conflicting evidence regarding the effectiveness of increased fibre intake for the treatment of obesity and overweight in adults.**

## Physical activity interventions alone

Only one systematic review (NIH, 1998) and two non-systematic reviews (Ross and Janssen, 1999 and 2001) have examined the effectiveness of physical activity alone for the treatment of adult obesity and overweight. The NIH (1998) report examined 13 RCTs and found that physical activity, ie aerobic exercise, in overweight and obese adults results in a modest (2-3kg) total weight loss independent of the effect of caloric reduction through diet. Ten studies had a diet-only group in addition to an exercise-only group, and in every case but one, the exercise-only group did not

experience as much weight loss as the diet-only group. Therefore diet alone was more effective than exercise alone.

In two non-systematic reviews, Ross and Janssen (1999 and 2001) stated that physical activity is associated with a reduction in total body fat in a dose response manner within high energy expenditure trials (2,200 kilocalories per week) that lasted less than four months. This was not observed in lower energy expenditure studies (less than 1,100 kilocalories per week) and did not occur in long-term (greater than four month) studies. In summary, the greater the energy expended by exercise, the greater the fat loss in the short term. These findings are broadly in line with the view of NIH (1998) that physical activity alone reduces total weight by about 2kg. The authors of the NIH review concluded: 'If the goal is to use exercise alone as a strategy for obesity reduction, exercise programmes would need to prescribe an energy expenditure of 3,000-3,500 kilocalories per week. This would require approximately 45-60 minutes of purposeful walking performed at a moderate intensity (70% maximum heart rate) on most days of the week.'

**There is evidence that increased physical activity is effective in producing a modest total weight loss. However, diet alone was more effective than exercise alone.**

## Physical activity and diet combined

Two systematic reviews were identified that considered diet and physical activity interventions. While reporting that physical activity alone, diet alone, and physical activity and diet combined were effective interventions in their own right, these reviews were primarily concerned with their relative effectiveness.

The NHS CRD (1997) review accepted only one study that combined physical activity and diet for the treatment of obesity. When diet and exercise were combined without a behavioural component, the combination was no more effective than diet and exercise as single interventions. However, this one study had small sample sizes and high rates of attrition, and so the results should be considered cautiously.

In contrast, the NIH (1998) report, applying different inclusion criteria, accepted 15 studies (Table 3). This review found that the combination of a reduced calorie

diet and increased physical activity produces greater weight loss than diet alone (2kg less) or physical activity alone (5kg less).

Despite the commonly accepted view that physical activity combined with diet is more effective than either diet or physical activity alone in producing weight loss, the systematic review evidence is conflicting.

**There is evidence that physical activity alone, diet alone, and physical activity and diet combined are effective interventions for the treatment of adult obesity and overweight. However, there is conflicting evidence regarding the relative effectiveness of physical activity and diet combined versus diet alone or physical activity alone.**

## Behavioural and/or cognitive therapy

Three systematic reviews examined the effectiveness of behavioural therapy (see Glossary), which is usually used to support other weight loss components (such as diet and physical activity) in the treatment of adult obesity and overweight (NHS CRD, 1997; NIH, 1998; Douketis et al., 1999). Based on 19 RCTs, NIH (1998) found that 'no one behavioural therapy appeared superior to any other in its effect on weight loss; rather multi-modal strategies appeared to work best (10% weight loss over 4-12 months) and those interventions with the greatest intensity (number of contacts and duration) appeared to be associated with the greatest weight loss'. Furthermore, 'long-term follow-up of patients undergoing behavioural therapy showed a return to baseline weight in the great majority of subjects in the absence of continued intervention'. The report concludes that 'behavioural therapy was a useful adjunct when incorporated into treatment of weight loss and weight maintenance'.

The Canadian review by Douketis et al. (1999) agrees that behavioural therapy can achieve weight loss during the initial 6 to 12 months; however, there is a gradual weight regain during the follow-up period (based on five RCTs and four prospective cohort trials – see Glossary).

In an additional analysis of 36 RCTs to evaluate whether behavioural therapy provides additional benefits above and beyond other weight loss approaches, it was found that 'behavioural therapy when used in combination with

other weight loss approaches, provides additional benefits in assisting patients to lose weight after one year. No additional benefits were found at three to five years in the absence of continued intervention' (NIH, 1998).

The NHS CRD (1997) review also investigated the effectiveness of behavioural therapy, although the analysis focused on individual interventions. It reported:

- The effectiveness of involving spouses in the treatment of obesity is unclear. The findings are conflicting and based on small sample sizes (four studies)
- Extending the length of behavioural therapy appeared to be more effective when compared to an intervention of shorter duration (one study)
- Group behavioural therapy may be of some use if followed by a successful maintenance programme (one study)
- Participation in a correspondence course that delivers lessons and homework is a promising approach that requires further research (one study)
- Provision of structured meal plans and grocery lists to overweight patients, in conjunction with behavioural therapy (see Glossary for definition), is effective and superior to behavioural therapy alone; however, the provision of meal plans and grocery lists need to be assessed in other populations. The provision of food was not found to provide additional benefits (two studies).

**There is evidence that a combination of behavioural therapy techniques in conjunction with other weight loss approaches is effective for the treatment of adult obesity and overweight over a one-year period.**

**Currently, there is limited\* evidence to support the use of the following for the treatment of adult obesity and overweight:**

- Extending the length of behavioural therapy
- Group behavioural therapy
- Correspondence courses
- Provision of structured meal plans and grocery lists.

**There is conflicting evidence regarding the involvement of spouses.**

The NHS CRD (1997) and NIH (1998) reviews also provided evidence on the effectiveness of cognitive therapy (see Glossary). Cognitive therapy may be performed as part of standard behavioural therapy. Of the six studies investigating cognitive strategies, cue avoidance (see Glossary) was the only technique with some evidence of effectiveness (one study in NHS CRD, 1997).

When comparing behavioural therapies, cognitive rehearsal (see Glossary) was no more or less effective than social pressure and cue avoidance (two studies in NIH, 1998).

Currently, there is limited\* evidence that the cognitive therapy technique of cue avoidance is effective in the treatment of adult obesity and overweight (individuals are asked to reduce their exposure to certain foods by changing their habits).

Currently, there is limited\* evidence that cognitive rehearsal is effective for the treatment of adult obesity and overweight (rehearsing one's thoughts and behaviours prior to a potentially difficult situation, and planning healthy adaptive responses).

## Intra-abdominal fat

Only one systematic review has investigated the impact of a range of interventions (increased physical activity, LCDs and behavioural therapy) on intra-abdominal fat (as part of total weight loss, not as a site-specific benefit). Despite conflicting results from three RCTs (physical activity alone versus controls) and several large observational studies, the NIH (1998) report concluded that increased physical activity in overweight and obese men and women modestly reduces intra-abdominal fat. LCDs were also consistently shown to reduce waist circumference (four RCTs lasting from 6 to 12 months). Finally, there was a lack of RCT evidence regarding the effect of behavioural therapy combined with diet and physical activity on intra-abdominal fat as measured by waist circumference.

These findings have been supported in a larger (although non-systematic) review of 23 studies (mainly short term) (Smith and Zachwieja, 1999). This showed that in both men and women most interventions demonstrated a preferential loss of intra-abdominal fat over total fat regardless of the intervention applied (exercise or diet). When individual

baseline body fat was higher or when an individual had a high proportion of intra-abdominal fat, a greater proportion of fat was lost from the abdominal region.

There is evidence that low calorie diets are effective in decreasing intra-abdominal fat. Currently, there is also limited\* evidence that increased physical activity is effective in reducing intra-abdominal fat in adults. The intra-abdominal fat loss occurs as part of total weight loss and is not a site-specific benefit.

## Maintenance of weight loss in adults

Obese individuals who have successfully lost weight are prone to relapse. The NIH (1998) report describes the maintenance of a lower body weight as a 'major challenge', and all weight loss approaches should be followed by a weight maintenance phase to reduce the possibility of weight regain. It is worth noting the important difference between the maintenance of weight loss (following a weight reducing intervention), and weight maintenance (a desirable outcome in the prevention of obesity). This section addresses the maintenance of any weight lost following a weight loss intervention. Two systematic reviews (NHS CRD, 1997; Fogelholm and Kukkonen-Harjula, 2000) have examined the effectiveness of weight loss maintenance approaches. The NHS CRD (1997) review identified five studies investigating the effect of continued therapist contact for weight loss maintenance. The effectiveness remains unclear; two studies did not show statistically significant differences in favour of continued contact, and one study showed weight regain occurring after the maintenance programme ended. However, adding self-help peer groups with therapist-led booster sessions was shown to be effective in two studies. One study in NHS CRD (1997) also suggests that the practice of daily weight charting may help maintain weight loss.

The same review also identified a one-year weight loss maintenance programme based on monthly meetings, comparing 'skills focus' with 'weight focus'. Skills focus involves training in dietary and exercise behaviours compatible with maintaining weight loss; weight focus emphasises the discussion of weight loss maintenance progress and problems, and addresses any difficulties using a non-specific problem solving strategy. Although the differences between the two were non-statistically

\* Limited is arbitrarily defined as three studies or less.

significant, and the study was small, the authors nevertheless concluded that weight focus was a promising strategy.

The use of formula diet preparations for weight loss maintenance was reported to be effective at one year follow-up (NHS CRD, 1997). But again, this finding was based on a single small study and the effect was not statistically significant. Finally, the same review concluded that it was unclear whether a weight loss maintenance strategy based on standard food or pre-packaged food was effective (one study).

A meta-analysis of 29 studies investigating long-term weight loss maintenance (Anderson et al., 2001) reported some interesting findings: VLCDs were associated with significantly greater weight loss than successful LCDs at all years of follow-up (up to five years). Furthermore, six studies reported that groups that exercised more had significantly greater success at maintaining weight loss than those who exercised less. However, this meta-analysis was not accepted for inclusion onto the HDA Evidence Base as it is based on observational USA-specific studies that showed significant heterogeneity. Therefore these findings need to be interpreted with caution and no firm conclusions can be drawn.

A systematic review on the effectiveness of physical activity in the maintenance of weight loss by Fogelholm and Kukkonen-Harjula (2000) included 16 prospective observational studies (see Glossary), 19 non-randomised weight reduction studies with an observational follow-up, eight randomised weight reduction interventions with a passive follow-up, and three interventions with a randomised weight loss maintenance phase. The findings were highly dependent on study design, intervention adherence and analytic design. For example, it was found that higher physical activity levels (1,500-2,000 kilocalories per week) are associated with improved maintenance of lost body weight. However, this effect was only observed in the prospective observational studies and the non-randomised weight reduction studies with observational follow-up. In comparison, findings from both the randomised weight reduction interventions with passive follow-up and the randomised weight loss maintenance phase studies showed that exercise training as a component of the maintenance intervention may have a positive, negative or indifferent effect on weight loss maintenance. The authors observed that the more rigorous study designs (such as randomised trials) yielded very inconsistent results, and suggested that the

association between physical activity and weight change is more complex than suggested by observational studies. They concluded that the results might be interpreted in three different ways: '(1) physical activity may really prevent weight gain; (2) less weight gain may lead to better exercise adherence; and (3) engagement in physical activity may be a proxy for a generally healthier lifestyle or psychological profile (eg better self-regulation).'

In addition, the review did not find any statistically significant differences in weight loss maintenance success between different kinds of activity (based on the randomised trials). Unfortunately, few groups have studied the effect of lifestyle activity or multiple sessions of short-bout exercise on weight change in overweight persons.

**There is conflicting evidence in relation to the effectiveness of continued therapist contact for weight loss maintenance.**

**Currently, there is limited\* evidence on the positive effects of self-help peer groups with therapist-led booster sessions on weight loss maintenance.**

**Currently, there is limited\* evidence on the positive effects of daily weight charting on weight loss maintenance.**

**Currently, there is a lack of evidence about the effectiveness of weight focus and skills focus programmes for the maintenance of weight loss. These programmes consisted of monthly meetings providing training in dietary and exercise behaviours compatible with maintaining weight loss (skills focus), or discussing weight loss maintenance progress and addressing difficulties using a non-specific problem solving strategy (weight focus).**

**The evidence of effectiveness for using standard or pre-packaged foods in the maintenance of weight loss is inconclusive.**

**The evidence of effectiveness for using formula diet preparations in the maintenance of weight loss is inconclusive.**

**There is conflicting evidence in relation to the effectiveness of increased physical activity (of 1,500-2,000 kilocalories per week) for weight loss maintenance.**

## Comprehensive interventions in adults

The NHS CRD (1997) review examined 11 comprehensive interventions which combined both treatment and maintenance. Findings indicated a number of effective strategies and pointers for weight treatment and maintenance:

- Continued therapist contact was effective when combined with behavioural therapy and relapse prevention training (three studies)
- One of the most effective combinations was a programme of behavioural therapy with continued therapist contact by mail and telephone (one study)
- No evidence was found to support the use of spaced versus massed booster sessions (one study)
- The value of spouse involvement in maintenance sessions requires further research (two studies).

**Currently, there is limited\* evidence to support the effectiveness of comprehensive interventions for weight treatment and maintenance. The following effective strategies were identified:**

- Continued therapist contact combined with behavioural therapy and relapse prevention training
- Continued therapist contact by mail and telephone.

**There is inconclusive evidence about the role of spouse involvement in weight treatment and maintenance.**

**Currently, there is a lack of evidence to support the use of spaced versus massed booster sessions for weight treatment and maintenance.**

## Settings

### Treatment of childhood obesity and overweight in schools

See previous section, 'Prevention of obesity and overweight in children' and 'Treatment of obesity and overweight in children', for a discussion of the findings from systematic reviews on school-based interventions. A further non-systematic literature review (Story, 1999) was identified which included 12 non-randomised controlled experimental studies on school-based treatment of childhood obesity. The majority (11 out of 12) compared the intervention group with a no-treatment control group. The programmes were administered to overweight children only and almost all programmes contained physical activity and nutrition education components.

The results of these studies were encouraging. In 11 out of 12 studies, the intervention group had a significantly greater reduction in the percentage of children classified as overweight, and an average 10% decrease in the body weight of individuals. Overall, interventions aimed at younger children were more successful than those with adolescents. Treatment effects were also generally greater for the heavier children.

Despite these positive findings, only two studies had a follow-up of at least six months, so the long-term effect of school-based treatment remains unknown. A few of the studies also had small sample sizes and in some cases non-participants were used as controls, which means motivational and personality factors may have influenced study outcomes. Further research is needed in this area to determine the most effective type of treatment. Long-term follow-up should be included in the evaluation. However, a concern has been raised in the literature regarding the suitability of schools as a setting for obesity and overweight treatment (Story, 1999). The stigma attached to participating in school-based treatment may decrease enthusiasm for the programmes and even produce negative psychosocial impacts. As a result of these concerns, few studies of school-based treatment have been identified since 1985, and this issue must be considered in future intervention design.

In addition to prevention programmes specific to obesity and overweight, there have been four broad-based cardiovascular disease (CVD) prevention programmes in

schools. These have not proved effective in reducing the percentage of overweight in children and adolescents. More specific programmes are likely to be needed to prevent excessive weight gain in children.

## Worksite health promotion programmes

Two systematic reviews were identified (Henrikus and Jeffery, 1996; Shephard, 1996) which examined the use of worksite settings for the treatment of obesity and overweight. Henrikus and Jeffery (1996), one in a series of reviews critically appraising the effectiveness of worksite health promotion programmes, looked at 44 studies of worksite interventions for weight control. Less than half had a follow-up of greater than six months and only one quarter were randomised studies, so the evidence base for this topic is methodologically weak.

The results of two RCTs suggest that 'worksite weight control programmes have been successful in producing modest short-term weight losses of about one to two pounds per week in programme completers. Greater adherence to programmes was related to better outcomes. Maintenance of weight loss for 6 months and 12 months after completion of the weight control programme varied greatly from study to study. The median maintenance rates for these two periods were 54% and 26% respectively.' Weight gain after treatment was the usual experience. The authors also concluded that the effectiveness of worksite interventions on modifying obesity prevalence in the entire workforce was not demonstrated.

Another review in the series, Shephard (1996), examined 52 studies on the effect of worksite fitness and exercise programmes. Again, only five of these were randomised and 14 were quasi-experimental programmes. In most cases the programmes showed a 'one to two per cent decrease in body mass over periods as short as 8 to 12 weeks, in the more effective programmes the decrease was as large as from three to six per cent. Moreover benefit persisted for as long as three years'. These losses occurred in the committed participants; the impact on the worksite community was smaller.

Furthermore, committed participants showed substantial changes in skinfold measurement and body fat content. The mean percentage change was 13% (ignoring the length of the programme) with 12 studies showing

improvements of 0% to 13% and seven studies showing larger changes. Factors contributing to a favourable outcome were also identified and included regular participation, intensity of the intervention, associated dieting, supervision of exercise and supplementation of the exercise programme with outreach, personal counselling and plant reorganisation.

Due to the short-term nature of many of these studies, the findings should be treated with caution. There is a need for more rigorous studies to evaluate the use of worksites as an appropriate setting for obesity and overweight treatment.

**There is evidence to support the use of worksite health promotion programmes for the treatment of obesity and overweight in adults. Positive programme factors include regular participation, intensity of the intervention, associated dieting, supervision of exercise and supplementation of the exercise programme with outreach, personal counselling and plant reorganisation.**

## Healthcare settings and the role of health professionals

Three systematic reviews (NHS CRD, 1997; NIH, 1998; Harvey et al., 2001) have examined the effectiveness of healthcare settings or considered health professionals' management of obesity and overweight.

The NHS CRD (1997) review identified one study investigating the use of inpatient versus outpatient management (using behavioural therapy in conjunction with diet and physical activity); inpatient treatment was found to be more effective at two years (mean weight loss 7.5kg) than outpatient treatment (3.1kg), but this effect did not last at the five-year follow-up. This single study therefore failed to demonstrate the superiority of either inpatient or outpatient management.

A more up-to-date Cochrane systematic review (Harvey et al., 2001) was conducted to determine the existence and effectiveness of interventions to improve health professionals' management of obesity and the organisation of care for overweight and obese people. Twelve studies were included in the review, of which 11 were RCTs and one a controlled before-and-after study. Studies were included regardless of the length of

follow-up. The authors found substantial heterogeneity between studies in terms of study design, comparison groups, intervention types, settings, participating health professionals and patients, which means an overall estimate of effect would have little practical meaning. As a result, a qualitative summary was presented, which stated it was difficult to draw meaningful conclusions on how the management of obesity and overweight might be improved.

Despite this finding, Harvey et al. (2001) reported some promising interventions, and recommended that improvements to the provision of services should be based on the existing evidence on interventions with patients and good clinical judgement. The HDA Evidence Base statement is based on the findings from this systematic review. Promising interventions included:

- Reminders to general practitioners (GPs) to prescribe diets
- A brief educational training intervention on obesity management delivered by behavioural psychologists to GPs
- Encouraging shared care between GPs and a hospital service
- Use of inpatient obesity treatment services
- Training for both health professionals and leaders of self-help weight loss clinics should be provided.

No studies were included which assessed whether negative attitudes among providers were impinging on good practice, and whether interventions to change attitudes might result in improved clinical decisions.

The healthcare setting is often the focus for smoking cessation, and the NIH (1998) report states: 'All smokers, regardless of their weight status, should quit smoking. Prevention of weight gain should be encouraged and if weight gain does occur, it should be treated through dietary therapy, physical activity and behaviour therapy, maintaining the emphasis on the abstinence from smoking. Although short-term weight gain is a common side effect of smoking cessation, this gain does not rule out the possibility of long-term weight control.' In contrast to this recommendation, in a non-systematic literature review of weight control interventions in conjunction with smoking cessation programmes, Varner (1999) found three quasi-experimental behavioural studies which were ineffective for weight control. It is not clear why these interventions were ineffective, and the

author suggests three possible causes: (1) the stresses associated with dietary restriction may cause bouts of overeating; (2) people have used nicotine as an appetite suppressant; and (3) weight management efforts in combination with smoking cessation efforts may have simply been overwhelming, with people asked to attempt too many lifestyle changes at one time. Furthermore, there is currently no review-level evidence on the effectiveness of obesity and overweight treatment within a smoking cessation setting.

**There is evidence to support improving the role of health professionals in the management of obesity and overweight, in particular by:**

- Reminders to general practitioners to prescribe diets
- A brief educational training intervention on obesity management delivered by behavioural psychologists to GPs
- Encouraging shared care between GPs and a hospital service
- Use of inpatient obesity treatment services
- Training provision for both health professionals and leaders of self-help weight loss clinics.

## Pregnancy

A Cochrane review (Kramer, 2001) identified three controlled studies assessing the effect of prescribing a low energy diet to pregnant women who were either overweight before pregnancy, or had gained excess weight during pregnancy. Two trials reporting on birth weight found that prescribing a low energy diet to overweight pregnant women is unlikely to be beneficial and may even be harmful to the developing foetus. As a result, the use of a low energy diet with this population group cannot be recommended.

However, this review does not fulfil several of the quality criteria of a standard Cochrane review, therefore these results should be treated with caution. An update is urgently required to confirm the review's findings.

## Conclusion

Tables 5 and 6 summarise the interventions shown to be effective in managing weight. In terms of treatment (children and adults), there is an abundance of evidence about what interventions work. There are also a number of promising interventions where further research is required. In terms of prevention, and maintenance of weight loss, there is an urgent need for more evidence. Finally, there is a large amount of evidence that is either conflicting, inconclusive, or limited (based on less than three studies). This applies especially to interventions with adults.

Obesity is a condition frequently described as an epidemic and is a focus of concern for government and non-government organisations around the world. The evidence base for the treatment of obesity and overweight is sound, but is greatly lacking in evidence for the prevention of excessive weight gain and strategies to promote the maintenance of weight loss. Under research conditions, obesity can be successfully treated, but this learning is not always being translated into practice. There is an urgent need to address the barriers to effective treatment in clinical practice.

**Table 5: The effectiveness of obesity and overweight interventions for children and adolescents**

	Evidence of effectiveness ❶	Current limited evidence of effectiveness ❷	Conflicting or inconclusive evidence ❸	Current lack of evidence of effectiveness ❹
Prevention	<ul style="list-style-type: none"> <li>• School-based multi-faceted interventions (particularly for girls) (nutrition education, physical activity promotion, reduction in sedentary behaviour, behavioural therapy, teacher training, curricular material, modification of school meals and tuck shops)</li> </ul>	<ul style="list-style-type: none"> <li>• School-based health promotion (classroom curriculum to reduce television, videotape and video game use)</li> <li>• Family-based behaviour modification programmes to impede weight gain (family therapy in addition to diet education, regular visits to a paediatrician and encouragement to exercise)</li> </ul>		<ul style="list-style-type: none"> <li>• School-based physical activity programmes (led by specialist staff or classroom teachers)</li> <li>• Family-based health promotion (strong focus on dietary and general health education and increased activity, involving sustained contact with children and parents)</li> </ul>
Treatment	<ul style="list-style-type: none"> <li>• Targeting parents and children together (family-based interventions involving at least one parent, with physical activity and health promotion)</li> <li>• Multi-faceted family-based behaviour modification programmes, where parents take primary responsibility for behaviour change in primary schoolchildren (diet, exercise, reducing sedentary behaviour and lifestyle counselling, with child management, parenting and communication skills training)</li> <li>• Laboratory-based exercise programmes (walking, jogging, cycle ergometry, high-repetition resistance exercise and combinations within a laboratory setting, as opposed to free-living lifestyle activity interventions)</li> </ul>	<ul style="list-style-type: none"> <li>• Behaviour modification programmes with no parental involvement (reduced calorie diet and an exercise programme, combined with cognitive-behavioural 'obesity-training', or muscle relaxation training)</li> </ul>		<ul style="list-style-type: none"> <li>• Family-based behaviour modification programmes (behaviour modification, dietary and exercise education with a mix of sessions involving the child, parent(s) or in some cases the entire family)</li> </ul>

Key to tables 5/6 – Each summary statement sets out the evidence regarding effectiveness based on the following factors:

- ❶ Evidence of effectiveness: derived from systematic reviews and meta-analyses which included four studies or more, where the results were all in agreement
- ❷ Limited evidence of effectiveness: derived from systematic reviews and meta-analyses that included three studies or less
- ❸ Conflicting or inconclusive evidence: derived from systematic reviews and meta-analyses where the interpretation and conclusions of the papers were not in agreement
- ❹ Current lack of evidence of effectiveness: applied to interventions in systematic reviews and meta-analyses which showed no current impact on obesity and overweight outcomes

**Table 6: The effectiveness of obesity and overweight interventions for adults**

	Evidence of effectiveness ❶	Current limited evidence of effectiveness ❷	Conflicting or inconclusive evidence ❸	Current lack of evidence of effectiveness ❹
Prevention			<ul style="list-style-type: none"> <li>Community-based interventions</li> </ul>	
Treatment	<ul style="list-style-type: none"> <li>Low calorie diets (1,000-1,500 kilocalories a day) (weight loss benefit includes reducing intra-abdominal fat – no site-specific benefit)</li> <li>Clinically prescribed very low calorie diets (400-500 kilocalories a day)</li> <li>Low fat diets with energy restriction</li> <li>Low fat diets, without targeting energy restriction (where less than 30% of energy is from fat)</li> <li>Increased physical activity alone</li> <li>Diet and increased physical activity combined</li> <li>Combinations of behavioural therapy strategies in conjunction with other weight loss practices</li> <li>Worksite health promotion programmes</li> <li>Reminders to GPs to prescribe diets delivered by behavioural psychologists</li> <li>Brief educational intervention for GPs</li> <li>Encouraging shared care between GPs and a hospital service</li> <li>Use of in-patient obesity treatment services</li> <li>Training for both health professionals and leaders of self-help weight loss clinics</li> </ul>	<ul style="list-style-type: none"> <li>Extending the length of behavioural therapy</li> <li>Group behavioural therapy</li> <li>Correspondence courses</li> <li>Provision of meal plans and grocery lists</li> <li>Cue avoidance (reduce exposure to certain foods by making a variety of changes to their habits)</li> <li>Cognitive rehearsal (rehearse thoughts and behaviours prior to a potentially difficult situation and use healthy adaptive responses)</li> <li>Increased physical activity for the reduction of intra-abdominal fat – no site-specific benefit</li> </ul>	<ul style="list-style-type: none"> <li>Relative effectiveness of clinically prescribed very low calorie diets versus low calorie diets over the long term (more than one year)</li> <li>Relative effectiveness of low fat with energy restriction diets versus low fat diets without calorie restriction alone</li> <li>Increased dietary fibre intake</li> <li>Relative effectiveness of physical activity combined with diet versus diet alone or physical activity alone</li> <li>Spouse involvement</li> </ul>	
Maintenance		<ul style="list-style-type: none"> <li>Self-help peer groups with therapist-led booster sessions</li> <li>Daily weight charting</li> </ul>	<ul style="list-style-type: none"> <li>Continued therapist contact</li> <li>Higher physical activity levels</li> <li>Formula diet preparations</li> <li>Standard or pre-packaged food</li> <li>Increased physical activity (of 1,500-2,000kcal per week)</li> </ul>	<ul style="list-style-type: none"> <li>Programmes focus on training in dietary and exercise behaviours compatible with weight loss; skills focus on discussing weight loss maintenance progress and addressing difficulties</li> </ul>
Comprehensive (treatment and maintenance combined)		<ul style="list-style-type: none"> <li>Continued therapist contact combined with behavioural therapy and relapse prevention training</li> <li>Continued therapist contact by mail and phone</li> </ul>	<ul style="list-style-type: none"> <li>Spouse involvement</li> </ul>	<ul style="list-style-type: none"> <li>Spaced versus massed booster sessions</li> </ul>

# Gaps in the evidence base and recommendations for research

It is clear from the effectiveness tables (Tables 5 and 6) that there are gaps in the review-level evidence for the management of obesity and overweight.

Based on the findings reported in the HDA Evidence Base papers and supplementary material, we have compiled a short list of the most urgent needs, presented in no particular order. It is important to note that we have not systematically searched for gaps in primary research, although some of the recommendations will impact on primary research.

Research should:

- Redress the balance by focusing on research that assesses the actual effectiveness of interventions, rather than the current research focus on measuring the prevalence and aetiology of obesity and overweight
- Focus on the prevention of obesity and overweight and the maintenance of weight loss in adults and children
- Redress the balance by focusing on 'upstream' interventions, such as policies or strategies at a national or regional level, and focusing on population and environmental interventions for the prevention of obesity and overweight in both children and adults, rather than individual interventions
- Target interventions attracting current policy attention, such as school-based health promotion and school-based physical activity programmes – where there is limited or no evidence supporting their implementation (see Tables 5 and 6)
- Include lower socio-economic, ethnic and vulnerable population groups in intervention studies to help address known inequalities
- Use high quality designs (for example RCTs) with adequate follow-up (at least one year), and include

process/qualitative information to allow features of effective interventions to be easily identified, and to provide cost effectiveness data

- Include an assessment of the psychosocial impact of interventions by collecting qualitative data on the views of participants
- Investigate the long-term sustainability of interventions
- Consider the barriers to the translation of effective strategies from research settings to clinical practice.

## Inequalities

From the systematic review and meta-analytic literature on the management of obesity and overweight, there is a complete lack of evidence regarding the effectiveness of interventions targeting specific socio-economic, ethnic or vulnerable groups. This reflects the general dearth of evidence in relation to public health interventions that address health inequality issues.

## Cost effectiveness

While a number of effective interventions have been identified in the systematic review and meta-analytic literature, there is no reported evidence on the cost effectiveness of these interventions.

## Intervention design

The authors of the HDA Evidence Base reviews have made the following recommendations for future intervention research (presented in no particular order).

- When undertaking evaluations of interventions, there is a need to collect, where possible, data relating to

the psychological profile of patients using appropriate and validated measures (NHS CRD, 1997)

- Studies should be undertaken to identify the patient-related variables that are likely to predict the effectiveness of interventions (NHS CRD, 1997)
- Information concerning gender, ethnicity, socio-economic features and genetic profiles should be routinely gathered (NHS CRD, 1997)
- The benefit of targeting specific groups or applying a whole population approach should be investigated (NHS CRD, 1997; NIH, 1998)
- Data should be collected on those who have dropped out of interventions
- Researchers should investigate what aspects of interventions appear to be effective or ineffective (eg types of setting, sources of advice, frequency of contact)
- Consideration needs to be given to the timing and naming of intervention components to allow appropriate evaluation. For example, weight loss is usually complete within three to four months and a weight management phase follows. Different weight management methods may be appropriate, and it might be useful for future projects to analyse loss and maintenance phases separately.

## Children and adolescents

### *Prevention*

- More research is required on the development of approaches shown to be effective for the prevention of obesity in children and adolescents (Campbell et al., 2001).
- There is a need to investigate further the effectiveness of family therapy for the prevention of obesity in different age groups and settings using larger sample sizes (NHS CRD, 1997).
- Interventions designed to reduce sedentary behaviour to prevent obesity should be replicated in non-USA settings, with larger sample sizes (NHS CRD, 1997).
- More research is needed to assess the effectiveness of promoting healthy lifestyle behaviours within a school setting.

### *Treatment*

- The role of parents in the treatment of child obesity needs further evaluation (NHS CRD, 1997).
- Further replication is needed of interventions designed to reduce sedentary behaviour for the treatment of obesity. This should be conducted in non-USA settings with larger sample sizes (NHS CRD, 1997).
- The characteristics of exercise programmes need further examination. The majority have been focused on aerobic exercise. However, there is little research on the best way to implement a programme and to maximise weight loss and adherence. The use of resistance training with children and young people should also be explored (Epstein and Goldfield, 1999).
- School-based approaches seem promising but further research is needed (Epstein and Goldfield, 1999). However, the psychosocial impacts of this type of intervention should also be considered (Story, 1999).

## Adults

### *Prevention*

- Future interventions need to be more explicit about methods of behaviour change, and use more objective measures of dietary intake and physical activity with longer follow-up periods (Hardeman et al., 2000).
- The effectiveness of community-based education programmes linked with financial incentives should be investigated further (NHS CRD, 1997).
- More evidence is needed on interventions to prevent weight gain with smoking cessation (NIH, 1998).

### *Treatment*

#### **Diet**

- It would be worth investigating the long-term effectiveness of LCDs and factors associated with compliance (NIH, 1998).
- The role of dietary fibre needs to be clarified (NHS CRD, 1997).
- The effectiveness of meal replacement products and other structured diets could be explored.
- The effectiveness of self-weight management, ie commercial weight loss organisations, diet books and magazines and over-the-counter slimming products, needs investigation and evaluation.

## Physical activity

- More research is required on methods to improve adherence to exercise programmes.
- Studies are needed on whether the type of exercise makes a difference.
- Research is needed to determine the optimum amount of physical activity to promote weight loss and maintenance, and prevent weight gain (NIH, 1998).

## Behavioural therapy

- Further RCT evidence is required on the effect of behavioural therapy combined with diet and physical activity on intra-abdominal fat (NIH, 1998).
- The influence of different types of counselling and support associated with dietary intervention could be investigated in a factorial design (Pirozzo et al., 2002).
- Behavioural interventions in primary care settings need further investigation (NIH, 1998).

## Maintenance of weight loss

- More research is needed to develop more effective maintenance programmes (NHS CRD, 1997).
- Behavioural interventions by correspondence and daily weight charting require further investigation (NHS CRD, 1997).
- Research is needed to identify the characteristics of individuals who have successfully maintained their weight loss over the long term (NIH, 1998).

## Settings

- Further research should be carried out on school-based approaches for the prevention of obesity and overweight in children. Studies, which should include long-term follow-up, are needed to determine the most effective type of treatment.
- More rigorous studies are required to evaluate the use of worksites as an appropriate setting for obesity and overweight treatment.
- The effect of worksite programmes on productivity and business costs (ie morale, job satisfaction, healthcare costs, absenteeism) should be investigated.
- Evidence on the effectiveness of obesity and overweight treatment within a smoking cessation setting is required.

## Health professionals

- Further studies are needed to assess whether negative attitudes among providers are impinging on good practice, and whether interventions to change attitudes might result in improved clinical decisions.
- The question of who should be the main providers of obesity and overweight treatment needs to be considered.

## Pregnancy

- An update of the Cochrane review by Kramer (2001) is needed.

# Glossary

## **Ad libitum diet**

A Latin term describing a non-prescribed, eat as you wish diet.

## **Behavioural therapy**

Behavioural therapy comprises any method to generate change in eating habits or lifestyle, including formal cognitive behaviour modification and training in behavioural skills for the management of obesity and overweight. Behavioural therapy of some form is always used with dietary therapy, but specific methods are seldom described.

## **Body mass index (BMI)**

BMI is calculated as follows:

$$\frac{\text{(Weight in kilograms)}}{\text{(Height in metres)}^2} = \text{BMI}$$

A desirable healthy body weight for adults is considered to be within the BMI range of 20 to 25. For epidemiological purposes, a BMI between 25 and 30 is considered to be overweight and above 30 is defined as obese. In children, body mass index changes substantially with age; at birth the median is low but increases at age one, decreases at age six and then increases at age 20. Therefore, a cut-off point related to age was developed to define child obesity using reference centiles (Cole et al., 1995; 2000).

## **Cognitive rehearsal**

Cognitive therapy is concerned with the modification of behaviour. The main principle of cognitive rehearsal involves making positive self-statements about a situation that is causing food temptation. This is followed by an adaptive behaviour such as walking away from the food temptation. Finally, individuals are encouraged to reward

themselves for doing well using positive statements or material rewards. The idea is to rehearse one's thoughts and behaviours before entering the potentially difficult situation, and to plan healthy adaptive responses.

## **Cognitive therapy**

Cognitive therapy is concerned with the modification of behaviour. The main principles of this treatment approach include the modification of current behaviour patterns, new adaptive learning, problem solving and a collaborative relationship between client and therapist. Cognitive therapy may be performed as part of standard behavioural therapy.

## **Cue avoidance**

A stimulus control technique often used in weight loss programmes in which individuals are asked to reduce their exposure to certain foods by making various changes in their habits.

## **Intra-abdominal fat**

Fat (adipose tissue) which is centrally distributed within the abdominal cavity and which is associated with greater health risk. This is often estimated simply from waist circumference.

## **Low calorie diets (LCDs)**

Diets containing less energy than an individual's energy needs – typically 1,000-1,500 kilocalories per day (as described in the HDA Evidence Base papers). They might also be defined as 700-1,500 kilocalories per day.

## **Low fat diets**

A diet where 30% or less of total daily energy is derived from fat (as described in the HDA Evidence Base papers).

### **Observational study**

An epidemiologic study that does not involve any intervention, experimental or otherwise. Nature is allowed to take its course with changes in one characteristic being studied in relation to changes in other characteristics.

### **Prospective study**

A planned study in which a group of individuals (a cohort), all free of a particular disease and varying in their exposure to a possible risk factor, are followed over a specific period of time to determine the incidence rates of the disease in the exposed and unexposed groups.

### **Quasi-experimental study**

An epidemiologic study similar in design to a randomised controlled trial. However, the subjects are not randomly allocated into study and control groups to receive or not to receive an experimental prevention or therapeutic product or intervention.

### **Randomised controlled trial (RCT)**

An epidemiologic experiment in which subjects in a population are randomly allocated into groups, usually called study and control groups, to receive or not to receive an experimental prevention or therapeutic product or intervention. The results are assessed by rigorous comparison of rates of disease, death, recovery, or other appropriate outcome in the study and control groups, respectively. RCTs are generally regarded as the most scientifically rigorous method of hypothesis testing available.

### **Very low calorie diets (VLCDs)**

Diets providing 400-500 kilocalories per day (as described in the HDA Evidence Base papers). Other definitions include 400-800 kilocalories per day (EU Reports on Tasks for Scientific Cooperation, 2001).

### **Waist, hips and waist-to-hip ratio (WHR)**

Waist circumference is measured at the mid-point between the lowest rib and iliac crest. Hip circumference is measured at the level of the great trochanters (or sometimes the widest part of the gluteal region). The waist-to-hip ratio (WHR) is calculated as follows:

$$\frac{\text{Waist measurement (cm)}}{\text{Hip measurement (cm)}} = \text{WHR}$$

There is increasing evidence that the distribution of fat in the body is as important as the relative weight of a

person. Many people store body fat in distinct ways, often called the 'apple' and 'pear' shapes – either around the middle (apple) or the hips (pear) – though some people fall in between this simple classification. For most people, carrying extra weight around the middle increases health risks more than carrying extra weight around the hips or thighs. Intra-abdominal fat (see above) is considered to have additional health hazards and is more typical of obese men than women. Waist-to-hip ratio was the first anthropometric index used to assess the risks associated with central fat distribution. Values of 0.95 or more in men and 0.85 or more in women are often used as cut-off points to indicate increased risk. Waist circumference correlates better with intra-abdominal fat and with health risks than WHR, and is considered a better measure. A large hip circumference may indicate high muscle mass as well as peripheral fat distribution and has some value in protecting against diabetes.

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# APPENDIX 1

## Search strategy

- 1 Meta Analysis/
- 2 metaanalys\$.ti,ab.
- 3 meta-analys\$.ti,ab.
- 4 meta analys\$.ti,ab.
- 5 cochrane.ti,ab,sh.
- 6 (review\$ or overview\$).ti.
- 7 review\$.pt.
- 8 (synthes\$ adj3 (literature\$ or research or studies or data)).ti,ab.
- 9 pooled analys\$.ti,ab.
- 10 ((data adj2 pool\$) and studies).mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 11 (medline or medlars or embase or cinahl or scisearch or psychinfo or psycinfo or psychlit or psychlit).ti,ab.
- 12 ((hand or manual or database\$ or computer\$) adj2 search\$).ti,ab.
- 13 ((electronic or bibliographic\$) adj2 (database\$ or data base\$)).ti,ab.
- 14 ((review\$ or overview\$) adj10 (systematic\$ or methodologic\$ or quantitativ\$ or research\$ or literature\$ or studies or trial\$ or effective\$)).ab.
- 15 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14
- 16 (retrospective\$ adj2 review\$).ti,ab,sh.
- 17 (case\$ adj2 review\$).ti,ab,sh.
- 18 (record\$ adj2 review\$).ti,ab,sh.
- 19 (patient\$ adj2 review\$).ti,ab,sh.
- 20 (patient\$ adj2 chart\$).ti,ab,sh.
- 21 (peer adj2 review\$).ti,ab,sh.
- 22 (chart\$ adj2 review\$).ti,ab,sh.
- 23 (case\$ adj2 report\$).ti,ab,sh.
- 24 (rat or rats or mouse or mice or hamster or hamsters or animal or animals or dog or dogs or cat or cats or bovine or sheep).ti,ab,sh.
- 25 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24
- 26 25 not (25 and 15)
- 27 15 not 26
- 28 editorial.pt.
- 29 letter.pt.
- 30 28 or 29
- 31 27 not 30
- 32 exp ANIMAL/
- 33 exp human/
- 34 32 not (32 and 33)
- 35 exp nonhuman/
- 36 exp human/
- 37 35 not (35 and 36)
- 38 34 or 37
- 39 31 not 38
- 40 exp obesity/
- 41 weight gain/
- 42 weight maintenance.mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 43 weight reduction/
- 44 (obesity or obese or overweight).ti.
- 45 body mass/
- 46 weight control.mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 47 waist hip ratio.mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 48 skinfold thickness/
- 49 fat substitute/
- 50 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49
- 51 behavior therapy/
- 52 (behaviour adj (therapy or modification)).mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 53 anorexigenic agent/
- 54 (appetite adj (suppressant\$ or depressant\$)).mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 55 low calory diet/
- 56 low fat diet/
- 57 (dieting or low calorie or diet\$).mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 58 exp food deprivation/
- 59 (food adj3 (deprivation or depriving)).mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 60 exp exercise/
- 61 exp kinesiotherapy/
- 62 exp physical activity/
- 63 physical activity.mp. [mp=title, abstract, subject

- headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 64 (exercise or physical therapy or fitness).mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 65 exp diet restriction/
- 66 fasting.mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 67 exp health education/
- 68 (prevent or prevention or preventing).mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 69 food policy.mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 70 exp feeding behavior/ and health care policy/
- 71 (program or programs or programme\$ or intervention\$).mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 72 guar gum.mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 73 alternative medicine/
- 74 (acupuncture or hypnotism).mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 75 advertizing/
- 76 weightwatcher\$.mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 77 ((diet or dieting or slimming) adj club\$).mp. [mp=title, abstract, subject headings, drug trade name, original title, device manufacturer, drug manufacturer name]
- 78 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77
- 79 39 and 50 and 78
- 80 limit 79 to (human and english language and yr=1996-2002)

## APPENDIX 2

### HDA Evidence Base – critical appraisal tool

Authors: \_\_\_\_\_

Title: \_\_\_\_\_

Source: \_\_\_\_\_

Relevance to topic			
Does this paper address your topic area?	Yes	No	Unsure
Circle the type of paper:			
• Systematic review			
• Meta-analysis			
• Synthesis			
• Literature review			
• Other review (please specify)			
Does it address (circle as appropriate)?			
• Effectiveness (interventions and treatments)			
• Causation			
• Monitoring and surveillance trends			
• Cost			
• Other (please specify)			
Transparency			
Does the paper have a clearly focused aim or research question?	Yes	No	Unsure
Consider whether the following are discussed:			
• The population studied	Yes	No	Unsure
• The interventions given	Yes	No	Unsure
• The outcomes considered	Yes	No	Unsure
• Inequalities	Yes	No	Unsure
Systematicity			
Do the reviewers try to identify all relevant English language studies?	Yes	No	Unsure
Consider whether details are given for:			
• Databases searched	Yes	No	Unsure
• Years searched	Yes	No	Unsure
• References followed up	Yes	No	Unsure
• Experts consulted	Yes	No	Unsure
• Grey literature searched	Yes	No	Unsure
• Search terms specified	Yes	No	Unsure
• Inclusion criteria described	Yes	No	Unsure
Is it worth continuing?	Yes	No	
Why/why not?			

<b>Quality</b>			
Do the authors address the quality (rigour) of the included studies? Consider whether the following are used:	Yes	No	Unsure
• A rating system	Yes	No	Unsure
• More than one assessor	Yes	No	Unsure
If study results have been combined, was it reasonable to do so? Consider whether the following are true:	Yes	No	Unsure
• Are the results of included studies clearly displayed?	Yes	No	Unsure
• Are the studies addressing similar research questions?	Yes	No	Unsure
• Are the studies sufficiently similar in design?	Yes	No	Unsure
• Are the results similar from study to study (test of heterogeneity)?	Yes	No	Unsure
• Are the reasons for any variation in the results discussed?	Yes	No	Unsure
What is the overall finding of the review? Consider: • How the results are expressed (numeric – relative risks, etc) • Whether the results could be due to chance ( <i>p</i> -values and confidence intervals)			
Are sufficient data from individual studies included to mediate between data and interpretation/conclusions?	Yes	No	Unsure
Does this paper cover all appropriate interventions and approaches for this field (within the aims of the study)? If no, what?	Yes	No	Unsure
<b>Relevance to UK</b>			
Can the results be applied/are generalisable to a UK population/population group?	Yes	No	Unsure
• Are there cultural differences from the UK?	Yes	No	Unsure
• Are there differences in healthcare provision with the UK?	Yes	No	Unsure
• Is the paper focused on a particular target group (age, sex, population sub-group etc)?	Yes	No	Unsure
<b>Accept for inclusion onto HDA Evidence Base?</b>	Yes	No	Refer to third party
<b>Additional comments</b>			

# Notes