2.0 Literature Review

The childhood and adolescent obesity epidemic is well documented (Kimm & Obarzanek, 2002; Lobstein et al., 2004; WHO, 1997) but despite this there remains a clear and urgent need for effective prevention and treatment strategies in order to tackle this growing problem. Many countries have paediatric weight management guidelines to promote best practice but at present many of these recommendations are based on low grade evidence (Oude Luttikhuis et al., 2009).

The dramatic rise in childhood obesity occurred predominantly from the mid 1970s onwards and the majority of the evidence that has been reviewed is from after this time as there is a general assumption that there will be few relevant published studies before then (Collins et al., 2006; Kumanyika, 2001). Efforts have been made to identify the most pertinent evidence currently available within the necessary time and resource constraints of this report.

There is currently a limited evidence base on effective strategies for both prevention and treatment as “clinical and public health responses to the epidemic have been overtaken by the speed and scale of the increase in obesity” (Reilly, 2006). A relatively small number of studies have been undertaken in the paediatric population and there are poor mechanisms in place for the evaluation of current initiatives. A synthesis review by Flynn et al. (2005), aimed at developing best practice recommendations, identified a lack of obesity prevention and treatment programming to address the specific needs of children and adolescents.
2.1 Prevention

The focus of this study is the treatment of overweight and obesity but references have been provided to direct the reader to the most significant obesity prevention work to date. Obesity prevention is recognised as an important objective in efforts to tackle the problem on a national scale in the Governments ‘Choosing Health’ White Paper (2004) and research has been undertaken to evaluate current prevention initiatives (Brown & Summerbell, 2009; Dehghan, Akhtar-Danesh & Merchant, 2005; Doak, Visscher, Renders & Seidell 2006; Flynn et al., 2005). School-based interventions and community programmes are popular settings for prevention initiatives due to the large amount of children that can be reached and the continued contact that such environments provide.

2.2 Treatment

For the 4.5 million children in the UK who are already overweight or obese, effective treatment interventions are clearly vitally needed and “will offer the only chance of reducing the probability of progression to adult obesity” (Collins et al., 2006). Strategies that affect a reduction in adiposity and that also effectively engage participants in achievable long-term lifestyle modification are needed to safeguard against a new generation of overweight and obese adults.

NICE has identified multi-component interventions that combine dietary modification, physical activity and behaviour change as the treatment option of choice (NICE, 2006). The current recommendations are that “interventions should include behaviour change strategies to increase physical activity levels or decrease inactivity, improve eating
behaviour and the quality of the diet and reduce energy intake” and the importance of addressing lifestyle within the family and social setting is also stressed (NICE, 2006).

Pharmacological and surgical interventions are included in some of the studies in this literature review but these are not in line with the current guidance from NICE regarding first line treatment and are therefore beyond the scope of this report.

Audits of traditional dietetic and paediatric approaches to treating paediatric obesity have identified that they are frequently ineffective (Quattrin, Liu, Shaw, Shine & Chiang, 2005; Stewart, Deane & Wilson, 2004). Much of the current understanding of treatment of childhood overweight comes from studies by Epstein et al. (1982; 1987; 1990; 1996 & 1999). These longitudinal studies provided pioneering evidence in the paediatric population and formed the foundations on which much of the more recent research has been based. Epstein’s research programme demonstrated modest and sustained weight loss in children five and ten years after the intervention; 34% of participants reduced their level of overweight by 20% or more and 30% moved out of the obese classification bracket (Epstein, Valoski, Wing & McCurley, 1990). However the generalizability of this research must be considered as much of Epstein’s work focused on subjects aged 6 – 12 years from white, middle-class, intact families.

The evidence available on interventions specifically aimed at treating childhood and adolescent overweight and obesity has been systematically reviewed and critically appraised by a number of authors in recent years (Collins, Warren, Neve, McCoy & Stokes, 2006; Oude Luttikuis et al., 2009; Reilly, 2006; Summerbell et al., 2003).
The updated Cochrane review of interventions for treating obesity in children (Oude Luttikhuis et al., 2009) includes 64 randomised controlled trials (RCTs) of interventions for young people (mean age under 18 years) with a minimum of six months follow up, published from 1985 to 2008. Only studies that observed participants for a minimum of six months were included in the review as it has previously been demonstrated that acute treatments can lead to significant weight loss (Epstein, Wing & Valoski, 1982; Miller, 1998) and because of the chronic nature of overweight and obesity it was deemed more important to evaluate the impact of treatment in the longer term. An important consideration highlighted by Rudolph et al. (2006) in relation to the current evidence base is that no high quality trials have been published in the UK to date.

Although the interventions included in this systematic review shared common aims and objectives, a large degree of heterogeneity in terms of intervention design, outcome measurements and study quality was identified and many studies were under powered, raising statistical concerns. It has been acknowledged that all included studies had some methodological weaknesses according to the criteria set out in the Cochrane handbook and other limitations included small sample sizes, compliance issues and high attrition rates and unadjusted outcomes measurements. Adverse effects of interventions were infrequently considered and follow-up over 12 months was very limited. Also a lack of generalisability of many of the studies included in this review has been acknowledged as a large proportion of the sample populations were motivated, middle class Caucasian subjects; it is imperative that lifestyle interventions are tailored appropriately to meet ethnic, social and economic diversity.
The conclusions from this Cochrane review are that at present there is insufficient quality data to recommend one particular treatment strategy over another in terms of effectiveness but meta-analyses showed a reduction in overweight at six and 12 months follow up for lifestyle interventions and indicated that family based, multi-component behaviour and lifestyle interventions can produce significant and clinically meaningful weight reduction in overweight and obese children and adolescents compared with standard care or self-help regimes. The need for more research was again acknowledged; “the mismatch between the high prevalence and significance of the condition and the limited knowledge base from which to inform treatment strategies remains a feature of this review” (Oude Luttikhuis et al., 2009).

2.2.1 Dietary Modification

A review by Collins et al. (2006) to assess the effectiveness of dietetic interventions in child obesity initially focused solely on studies with dietary intervention as the exclusive treatment component, but due to a very limited number of studies identified (seven in total) the review was expanded to include dietary intervention in combination with other treatments (i.e. lifestyle modification and/or psychological therapies). 37 RCTs were evaluated in this systematic review and significant heterogeneity of interventions was reported; only two meta-analyses could be presented. A similar systematic review by Gibson, Peto, Warren and Santos Silva (2006) to assess dietary interventions to reduce weight in childhood and adolescence reiterated these findings, only identifying nine such studies and reporting that “most of these were too small to be informative and none provided evidence on long-term weight control.”
These reviews concluded that making evidence-based dietary recommendations was not possible due to the “the paucity of quality research in this area” (Collins et al., 2006) and the heterogeneity of the studies evaluated (i.e. quality, design, intervention and follow-up duration, outcome measures etc). It was cautiously concluded that dietary modification in the form of a reduced energy diet can be effective as part of a multi-component intervention in improving weight-related outcomes but that the limited quality evidence base and lack of long-term follow up data made it impossible to draw firm conclusions at this time. Larger, consistent, intervention trials with adequate follow-up have been recommended to enable comparisons to be made.

2.2.2 Physical Activity

The recent increase in sedentary behaviours and decline in daily physical activity levels are major factors contributing to the current obesity epidemic (Saris et al., 2003). The current recommendations for physical activity in children and adolescents are 60 minutes of moderate to vigorous physical activity per day (NICE, 2006) but the relationship between physical activity and overweight is not as straightforward in the paediatric population as it is in adults because of the complicating factor of changing weight due to growth. However a longitudinal study by Berkey, Rockett, Gillman and Colditz (2003) provided evidence that increasing physical activity and/or decreasing inactivity is associated with a reduction in relative overweight in young people and it is known that physical activity plays an important role in preventing weight regain (Epstein & Goldfield, 1999).

Several studies have identified that overweight adolescents are less engaged in, and perceive more barriers to physical activity than their non-overweight counterparts
(Deforche, Lefevre, De Bourdeaudhuij, Hills, Duquet & Bouckaert, 2003; Trost, Kerr, Ward & Pate, 2001; Zabinski, Saelens, Stein, Hayden-Wade & Wilfley, 2003) and positive correlations have been revealed between time spent watching television and childhood obesity (Crespo, Smit, Troiano, Bartlett, Macera & Andersen, 2001; Ma, Li, Hu, Ma & Wu, 2002). However, it must not be assumed that physical inactivity and sedentary activities go hand in hand in all cases; a cross-sectional study using cluster analyses in underweight, normal-weight and overweight adolescents from the UK and USA revealed that sedentary behaviours can sometimes compete with and sometimes co-exist with physical activity (Marshall, Biddle, Sallis, McKenzie & Conway, 2002).

Increasing physical activity and/or decreasing inactivity, along with the challenges of motivating participants to adhere to lifestyle changes, have therefore become principal elements of both prevention and treatment strategies for overweight and obesity. An important consideration when developing interventions is to ensure that activity programmes are tailored appropriately to the fitness levels of the participants as failure to do so can negatively affect future participation in physical activity (Deforche et al., 2003).

2.2.3 Behaviour Modification

The use of behavioural change techniques in the treatment of paediatric obesity is not well documented. Epstein and Goldfield (1999) proposed the use of behavioural strategies to increase participation in physical activity but a systematic review by Summerbell et al. (2003) concluded that the literature is currently limited to “marginal quality trials involving small samples of primarily white, school-aged children receiving short-term, non-comparable, non-generalizable interventions”. A summary of evidence of screening and interventions for childhood overweight (Whitlock, Williams, Gold, Smith & Shipman, 2005)
advised that behavioural therapy must not be thought of as an add-on to a dietary and physical activity programme but as an “expertise-driven approach to improving diet and activity levels” and called for further research to confirm that behaviour modification is key to successful weight management treatment interventions in children and adolescents.

2.2.4 UK Treatment Interventions

The multi-component treatment interventions that are currently available in the UK include:

**Community:**
- MEND
- WATCH IT!

**Residential:**
- Wellspring UK
- Carnegie International Camp

**Community:**

**MEND**

Sacher, Chadwick, Wells, Williams, Cole and Lawson (2005) presented the results from an uncontrolled pilot study of MEND (Mind, Exercise, Nutrition, Do it!), a multi-component, community, family-based intervention, in a group of obese 7-11 year old children. The programme design is 12 week duration, bi-weekly two hour sessions for children and parents held at local community facilities. An hour of nutrition education for the whole group is followed by a physical activity session for the children and a parents’ only support session. The primary outcome measure in this study was waist circumference, which is not in line with current NICE guidance. Secondary outcome measures included BMI, cardiovascular fitness (CVF), self-esteem and body composition. The findings from this study indicated that waist circumference, CVF and self-esteem were all significantly improved at three months and continued to improve at six months. BMI was significantly improved at three months but lost significance by six months. The limitations of this study
An evaluation to review the effectiveness of an established residential weight management intervention on short term health outcomes in overweight and obese children and adolescents.

include the small sample size (11 children and their families), lack of a control group and a primary outcome measure that is not in agreement with current guidance. However this was only a pilot study; the results indicate that the MEND programme was acceptable to participants and produced significant improvements in a range of risk factors associated with obesity that persisted over three months, but further more robust evaluation is require to determine its clinical efficacy.

**WATCH IT**

This three monthly rolling programme for 8-16 year olds and their families, set up in 2004 (Rudolph et al., 2006), comprises four key components – individual appointments, healthy education lifestyle plans, group activity sessions and parental group sessions. The intervention is run by health visitor trainers, who have undertaken specific training, at local community facilities. BMI standard deviation score (BMI SDS) was the primary outcome measure; the results from the published pilot study revealed a statistically significant decrease in BMI SDS scores (-0.07, p<0.01) in 71% of participants at six months and reported increases in friendships and self-confidence. The limitations of this pilot study have been acknowledged and it has been highlighted that it was preliminary work to assess the implementation of the Watch It programme. A RCT is currently being developed to assess its clinical effectiveness as a generalisable, low cost intervention.

**Residential interventions:**

Residential programmes offer a unique treatment opportunity as a much greater control of external variables can be achieved. However such programmes do create an unnatural environment and must include the development of ‘coping’ strategies to enable the positive changes implemented during the intervention period to continue when the participant
returns to their home environment and is exposed to the variety of external stimuli and influences that were removed or minimised during the residential experience.

There are currently few studies that have evaluated residential programmes; firstly there are few such programmes available and programme heterogeneity of those that are available makes comparisons difficult.

**Wellspring**

Weight loss camps have been popular in the USA for some time and the most established intervention is the Wellspring Camp; a multi-component fitness and weight loss programme which has recently been introduced to the UK. To the authors knowledge there is no published data available from the UK Wellspring camp to date, but the main components of this residential programme in the USA include the use of a very low-fat diet (<20g fat/day), cognitive behaviour therapy (CBT) and family involvement (two-day family workshops). Evaluation studies of the USA Wellspring programme demonstrate an average weight loss of 1.85kg per week and significant improvements in fitness and mood during the intervention (Kischenbaum, Craig, Kelly, & Germann, 2007).

**Carnegie International Camp**

The only UK residential programme that has undergone the evaluative process is the Carnegie International Camp (CIC); a holistic and evidence based programme for 8-17 year olds established in 1999 by Carnegie Weight Management, Leeds Metropolitan University. The CIC runs annually in the north of England and has been evaluated by Gately, Cooke, Barth, Bewick, Radley and Hill (2005). This study examined the first four cohorts participating in the CIC programme from 1999-2002 and the intervention was
shown to be effective in the short term against a range of health outcomes; the results demonstrated significant reductions in BMI, fat mass, blood pressure and waist circumference, and improvements in aerobic fitness and self-esteem in participants (BMI reductions = 2.4 units, BMI SDS reductions = 0.28, fat mass reductions = 5.6kg for campers who stayed for a mean of 29 days. 80% of campers reduced their BMI between 1.0 and 3.4 units).

2.4 Gaps in the Literature

Significant gaps in the current evidence base and study design weaknesses in terms of the validity and generalisability of treatment interventions have been identified and there is a consensus that there is an “urgent need for more research on improved approaches to the prevention and treatment of childhood obesity across the world” (Reilly, 2006). These issues have been previously highlighted (Robinson, 1993) but subsequent research has not yet satisfactorily ‘filled the gaps’ and the need for more quality studies in this area remains; Whitlock et al. (2005) called for “larger trials, testing generalisable interventions that can demonstrate sustained effects on overweight status and weight related outcomes”.

The systematic reviews explored in this literature search included RCTs exclusively as they are considered to be the gold standard in experimental study design; RCTs are at the top of the traditional hierarchy of evidence as it is considered that they provide the lowest risk of bias, the strongest evidence of cause and effect and they allow for meta-analysing. However, utilising only RCTs leads to the elimination of many studies that could possibly provide applicable data. It is widely acknowledged that there is limited data available at
present in the field of paediatric obesity treatment and it has recently been suggested that innovative non-RCT interventions with rigorous external evaluation may also provide useful evidence (Oude Luttikhuis et al., 2009). A report by Doak, Visscher, Renders and Seidell (2005) recommended “evaluation and publication of all interventions, as even interventions with an imperfect study design, small sample size or no effective results in terms of behaviour change or outcome measures can be used to inform future interventions”.

2.5 The Current Study

Based on the current literature available, multi-component interventions that combine dietary modification, physical activity and behaviour change have been identified as the treatment option of choice for overweight and obesity (NICE, 2006). One such treatment initiative is the Carnegie International Camp (CIC); as previously outlined the CIC programme has been shown to be effective in the short term against a range of health outcomes for overweight and obese children and adolescents.

It is known that the findings from a single study seldom provide convincing evidence and new findings are usually accepted only when there is a substantial body of research, involving several studies (Crombie, 2003). On-going research and appropriate evaluation is imperative to ensure that interventions remain relevant to the needs of the participants as well as being aligned to the current evidence base on childhood obesity treatment. Findings from new research and appropriate evaluation can be disseminated and utilised to ensure continued development and communication of best practice.

Direct comparison between different weight management interventions is difficult due to heterogeneity in programme design, quality, target population, theoretical underpinning
and outcome measures. However, repetition of existing studies provides benefits such as increased sample size, reduces variation of results and increases confidence in the effects of the experimental factor being examined.

Therefore this study aims to evaluate whether the CIC residential weight management programme continues to be effective by replicating the evaluation undertaken by Gately et al. (2005) in order to compare the outcomes of the 2006-2008 cohorts to those previously reported (1999-2002 cohorts).