The mediating role of appearance-related schema in the pattern of eating attitudes and behaviour in adolescents with Type 1 Diabetes.

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by

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Declaration

I confirm that the literature review and research report contained within this thesis have not been submitted for any other degree, or to any other institution.

The mediating role of appearance-related schema in the pattern of eating attitudes and behaviour in adolescents with Type 1 Diabetes

Gemma Ward

Thesis Abstract

Deteriorating metabolic control in adolescents with Type 1 Diabetes Mellitus (T1DM) has been closely linked with: the emergence of eating disorders, sub-clinical disordered eating, and treatment non-adherence - namely the use of insulin omission, a unique form of calorie purging behaviour, often referred to as *diabulimia*. Co-morbidity of T1DM and disordered eating/treatment non-adherence is known to compromise metabolic control, and expedite short and long-term detrimental health outcomes.

To most effectively mitigate adverse health outcomes and improve the metabolic control of adolescents with T1DM, a greater understanding of these behaviours, along with precipitating factors, is warranted to permit effective screening and prevention strategies.

A systematic literature review was conducted to determine what is currently known about *diabulimia,* the use of insulin manipulation as a weight management strategy. Fourteen studies were reviewed, all of which found evidence of insulin manipulation for weight control, with rates varying between 1%-37%. The results of the studies were discussed in relation to the methodologies used, aetiological factors and the health consequences of this behaviour. Body dissatisfaction was found to have an aetiological role in the use of insulin manipulation, but was often not addressed rigorously, a finding which was addressed in the research paper.

A questionnaire survey of 113 adolescents with and without T1DM was conducted to investigate the role of body image (appearance-related schema) in the pattern of eating attitudes and behaviour. Adolescents living with T1DM were not found to experience greater difficulties with eating or body-image than adolescents living without T1DM. Although no between-group differences were found, 7.7% of adolescents living with T1DM achieved clinical caseness on a measure of eating attitudes and behaviour. Appearance-related schemas were not found to predict disordered eating. Possible explanations, methodological difficulties and implications for future research and clinical practice were discussed.

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Target journal for literature review and Research Paper

British Journal of Health Psychology

Notes to Authors – Appendix 12

Word Count

	Without references	With references
Thesis Abstract	293	293
Literature Review	7,224	8,942
Research Report	11,889	14,461
Critical Appraisal	2,353	2,576
Appendices		3,931
Total		**30,203**

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Literature Review: The impact of weight-related concerns on diabetes-specific weight management practices in adolescents with Type 1 Diabetes: Implications for health outcomes.

1.0 Abstract

Deteriorating metabolic control in adolescents with Type 1 Diabetes Mellitus (T1DM) has been closely linked with the emergence of eating disorders. Co-morbidity of T1DM and eating disorders is known to compromise metabolic control (Rydall, Rodin, Olmsted, Devenyi & Daneman1997; Bryden, Neil, & Mayou, 1999). Individuals with T1DM have at their disposal the use of insulin omission, a unique form of calorie purging behaviour. The aim of this review was to critically review available research on the impact of weight-related concerns on the misuse or omission of insulin in adolescents with T1DM, in conjunction with the implications for health outcomes in this population.

PsycINFO, MEDLINE and CINAHL were searched using a keyword and MeSH heading search. A total of 504 articles were elicited. Application of exclusion criteria reduced abstracts by 490. A data extraction tool was developed and utilised to review the content, methodology and empirical findings of the 14 remaining articles.

All 14 articles found evidence of the practice of insulin manipulation for weight control or loss, with rates varying between 1%-37%. An association existed between weight/shape concerns and the use of insulin manipulation for weight loss purposes (Ackard, Neumark-Stainzer, Schmitz, Hanman, & Jacobs, 2008; Peveler, Bryden, & Neil, 2005; Khan & Montgomery, 1996). Those with eating disorders engaged in this behaviour more readily (Jones, Lawson, Daneman, Olmsted, & Rodin, 2000; Rodin, Craven, Littlefield, Murray & Daneman, 1991; Peveler et al., 2005), as did those in the later adolescent and early adult developmental periods (Colton, Olmsted, & Daneman 2004;2007; Fairburn, Peveler, Davies, Mann, & Mayou, 1991). Insulin manipulation was shown to be associated with: higher HBA_{1C} measurements, serious micro-vascular complications, hospital admissions and diabetic ketoacidosis (Peveler, Fairburn, Boller, & Dunger, 1992; Peveler et al., 2005; Howe, Jawad, Kelly, & Lipman, 2008).

The understanding of insulin manipulation as a health phenomenon in its own right is limited. It is important that detection and intervention of this behaviour is improved in the clinical setting, and is considered in individuals in the pre-adolescent phase. If preventative measures can be employed, the use of insulin manipulation as a weight loss strategy, and consequently, detrimental health outcomes, may be reduced in adolescents.

Keywords: Type 1 Diabetes, Eating Disorders, Disordered Eating, Weight Control Practices, Weight Management, Weight-related Concerns, Weight and Shape Concerns, Body Image, Body Dissatisfaction, Insulin Omission, Insulin Misuse.

2.0 Introduction

2.1 Metabolic Control in Adolescence

Type 1 Diabetes Mellitus (T1DM), one of the most common chronic conditions of childhood and adolescence, affects 0.3-0.6% of individuals by age 20 years (Drash, 1987). Adequate metabolic control requires adherence to a treatment regimen, including multiple daily insulin injections, blood sugar measurements, and planning the content and timing of food. Evidence suggests that, in general, metabolic control deteriorates in adolescents with T1DM compared to younger children and adults (Mortensen et al., 1998). Adolescence, a time of rapid growth in physical, emotional and psychological domains, is a developmental period that poses additional challenges for the adolescent with diabetes, as they seek a more autonomous lifestyle and independence with their diabetes care, develop a higher Body Mass Index (BMI), and manage dietary restraint. Whilst insulin resistance of puberty underpins deterioration of metabolic control during adolescence (Hamilton & Daneman, 2002), psychosocial challenges also appear to be significant causative factors in deteriorating metabolic control.

2.2 Causative Factors in Deteriorating Metabolic Control

A deterioration of metabolic control is often associated with non-adherence, with up to 45% of adolescents presenting with a period of 'pervasive non-compliance' in three main domains of diabetes care: insulin injections, self-monitoring routines and meal planning (Kovacs et al., 1990).

Causal factors for non-adherence in this developmental time frame have been explored in a number of studies (Weissberg-Benchell et al., 1995; Bruch, 1984; Humphrey, 1987; Jones, Lawson, Daneman, Olmsted, & Rodin, 2000). The increasing independence adolescents have over their diabetic regimens, including less reliance on parental supervision,

seems to coincide with greater prevalence of insulin omission and fabricated blood glucose results, with non-compliance being positively correlated with deteriorating metabolic control (Weissberg-Benchell et al., 1995; Morris et al., 1997). The functioning of families has also been investigated (Bruch, 1984; Humphrey, 1987), with supportive, cohesive families displaying low levels of conflict associated with good adherence and metabolic control in their adolescent members (Burroughs, Harris, Pontious, & Santiago, 1997; Hauser et al., 1990). Inappropriate diabetes management due to knowledge or technical difficulties (Ltief & Schwenk, 1999), along with the emergence of eating disorders during this developmental time frame have been cited as significant contributory factors to deteriorating metabolic control (Jones et al., 2000).

2.3 The Role of Eating Disorders

Deteriorating metabolic control in adolescents has also been closely linked with the emergence of eating disorders within the adolescent and early adult developmental stages. Formal diagnostic criteria for eating disorders comprise three categories: Anorexia Nervosa (AN), Bulimia Nervosa (BN), and Eating Disorders not otherwise specified (EDNOS), where the eating disorder is clinically significant but does not meet the criteria for either AN or BN. In all three eating disorders self-evaluation occurs based heavily on weight and shape (American Psychiatric Association, 1994).

Adolescent girls with TIDM appear to present with a twofold increased risk of developing an eating disorder compared with their non-diabetic peers (Jones et al., 2000), with a further cadre of studies applying Diagnostic Statistical Manual of Mental Disorders (DSM) criteria revealing approximately 10% of adolescent diabetics diagnosable with an eating disorder (Fairburn, Peveler, Davies, Mann, & Mayou, 1991; Peveler, Fairburn, Boller, & Dunger, 1992; Affenito et al., 1997), most notably bingeing and purging (Fairburn & Beglin, 1990).

2.4 The Link between Eating Disorders and T1DM

To date there is not complete consensus explaining why individuals with T1DM are at a higher risk than their non-diabetic peers (Popkin, 1989; Rodin & Daneman, 1992; Hall, 1997), but a number of perspectives have been advanced. T1DM may influence normal developmental processes, potentially leading to low self-esteem and impaired self-concept development (Hauser, Jacobson, Noam, & Powers, 1983; Jacobson et al., 1986). At a time when self-concept is the subject of developmental alterations, diabetes may expose adolescents to further risk factors associated with the development of eating disorders, including body dissatisfaction (Jones, et al., 2000), higher BMI (Domargard, Sarnblad, & Kroon, 1999), dietary restraint (Daneman, Olmsted, & Rydall, 1998), and depression (DeGroot, Anderson, & Freedland, 2001).

Higher BMI, weight and shape concerns, low self-esteem, and depressed mood have all been shown to act as risk factors for the development of disturbed eating behaviours in adolescents with T1DM (Colton, Olmsted, & Daneman, 2007). Based on the available research, Goebel-Fabbri, Fikkan, and Connell (2002) proposed the following model of eating disorders in T1DM (Figure 1).

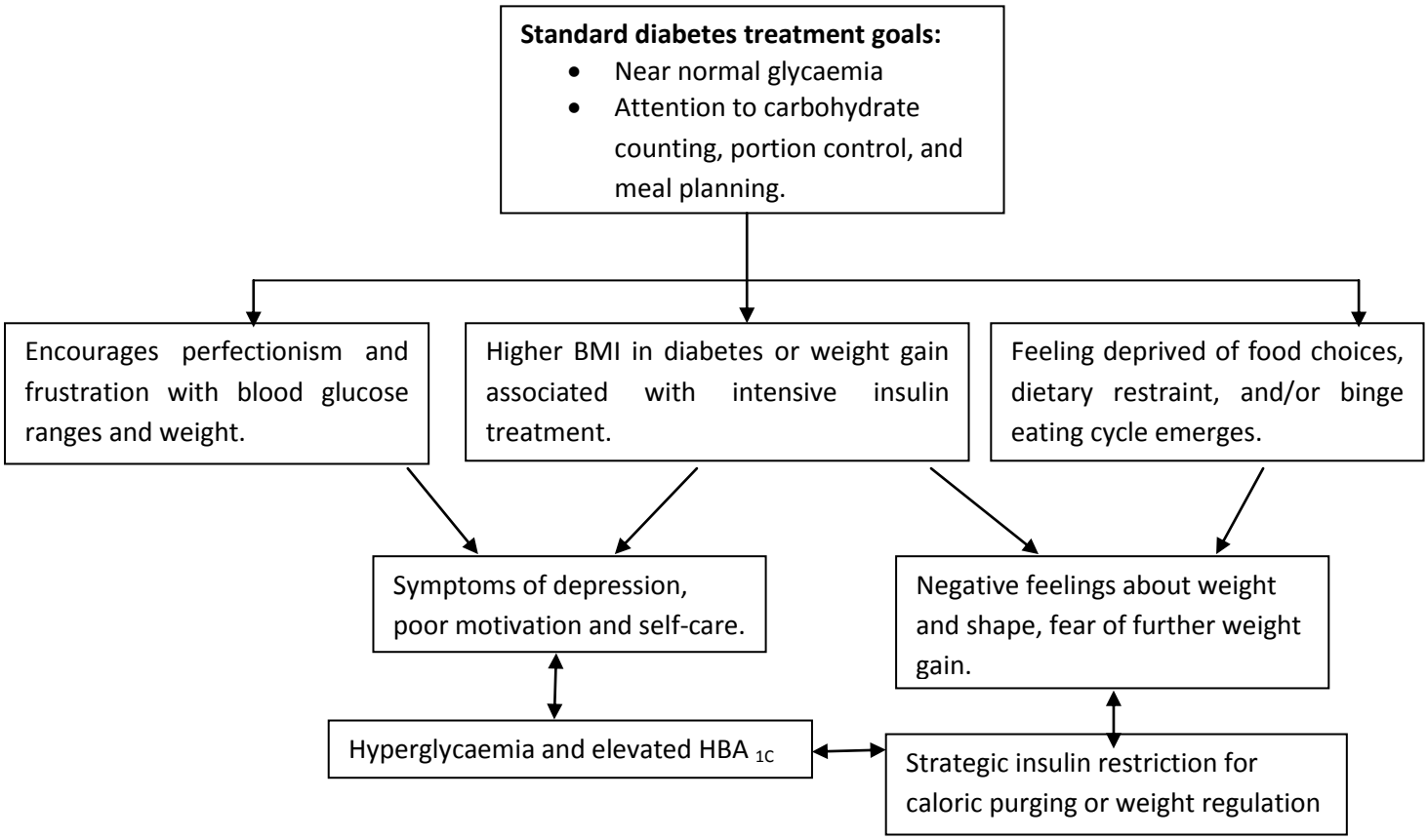

Figure 1. Model of eating disorders in T1DM.

2.5 Eating Disturbances and T1DM

In addition to diagnosable eating disorders, individuals can also engage in sub-clinical disturbed eating behaviour, behaviour consonant with eating disorder symptoms but not at the level or frequency to merit a formal diagnosis. Such behaviours are common amongst adolescent girls (Olmsted, Colton, Daneman, Rydall, & Rodin, 2008). These include: dietary restriction, binge eating, self-induced vomiting, laxative or diuretic use, excessive exercise, and insulin restriction in the case of individuals with T1DM. Those with T1DM are, however, more likely to exhibit two or more disturbed eating behaviours than their non-diabetic peers (Colton, Olmsted, & Daneman, 2004), and are 1.9 times more likely to develop a sub-threshold eating disorder (Jones et al., 2000). These behaviours tend to persist and increase in

severity over time (Peveler, Bryden, & Neil, 2005; Colton, et al., 2004), and are commonly associated with the development of clinical eating disorders (Striegel-Moore & Bulik, 2007).

2.6 The Role of Insulin Omission in Unhealthy Eating Attitudes and Behaviour

Individuals with T1DM have at their disposal the use of insulin omission, a unique form of calorie purging behaviour. When less insulin is taken than is required to match carbohydrate intake, or to meet the body's basal insulin requirements, patients induce hyperglycaemia and glycosuria, impairing glucose utilisation and degrading fat and muscle stores to produce energy. This dangerous practice seems to rise during adolescence, with 1% reporting in the preteen years (Colton, Daneman, Olmsted, & Rodin, 2000), 11-14% in the mid-teen years (Jones et al, 2000), and 34% in older adolescents and young adults (Rydall, Rodin, Olmsted, Devenyi, & Daneman, 1997). Reviews have noted that the rates of intentional insulin omission are higher than rates of diagnosable eating disorders, particularly in females (Crow, Keel & Kendall, 1998), and tends to be higher in individuals with a diagnosable eating disorder (Rodin, Craven, Littlefield, Murray & Daneman, 1991), suggesting that insulin misuse or omission is weight or eating related, rather than an expression of more general concordance difficulties with diabetes management.

2.7 The Role of Body Satisfaction in the Development of Unhealthy Eating Attitudes and Behaviour

Body image is of particular concern in the adolescent developmental period. In combination with female sex, body size, and body image, the later adolescent development period is predictive of the development of disordered eating in both healthy individuals and those with diabetes (Engstrom et al., 1999; Meltzer et al., 2001; Neumark-Stainzer et al., 1996). The role of body satisfaction has been advanced as mediating the link between T1DM and disordered eating, with weight gain associated with insulin treatment considered as a risk

factor for increased levels of body dissatisfaction (Khan & Montgomery, 1996; Neumark-Sainzer et al., 1996). The development of disordered eating behaviours in girls with T1DM is predicted by BMI percentile, concerns with weight and shape, and lower self-esteem related to physical appearance (Olmsted et al., 2008).

2.8 Health Outcomes of Unhealthy Eating Attitudes and Behaviour and Clinical Implications

Short-term complications such as diabetic ketoacidosis (DKA), and long-term microvascular complications affecting the eyes, kidney and peripheral nerves can occur when optimal metabolic control is not achieved over a period of years (Diabetes Control and Complications Trial [DCCT], 2000). Intentional insulin restriction/omission, and the consequent inducement of hyperglycaemia and glycosuria, produces ketone bodies, resulting in DKA and a shift in the body's pH balance, expediting acutely life threatening consequences (Kahn, 1994).

Co-morbidity of T1DM and eating disorders is known to compromise metabolic control. Haemoglobin A_{1C} (HBA_{1c}) levels of individuals with T1DM and eating disorders may be two or more percentage points higher than their non-diabetic peers, with higher rates of hospital admissions, and increased risk of microvascular complications, such as neuropathy and retinopathy (Rydall et al., 1997; Bryden, Neil, & Mayou, 1999). Insulin restriction alone appears to increase mortality risk three fold (Goebel-Fabbri, Franko, & Paerson, 2008), and, worryingly, disordered eating status was more predictive of diabetic retinopathy at follow up than the duration of diabetes itself, a well established risk factor (DCCT, 1993). The presence of sub-clinical eating disturbances can also have significant consequences for metabolic control, leading to diabetic related complications (Khan & Montgomery, 1996; Rydall et al., 1997). Girls with new onset disturbed eating behaviours have also been shown to exhibit poorer metabolic control, suggesting that mild and relatively new disturbances in eating can have a significant impact (Olmsted et al., 2008).

2.9 Aims of Review

Research has grown over the last two decades, since initial case reports articulated potential and actual catastrophic consequences of disordered eating on outcomes for those with T1DM. Whilst factors precipitating and mediating this link are as yet not fully understood, the link between T1DM and disturbed eating behaviours seems conclusive, with a focus developing beyond diagnosable eating disorders to the clinical consequences of sub-clinical eating disturbances.

The specific role of insulin manipulation in weight management is of particular concern, with potentially disastrous short and long-term health consequences. Its prevalence has been shown to be higher than any other form of weight reduction strategy for those with diabetes (Crow et al., 1998), and occurs in those with and without eating disorders. To most effectively mitigate adverse health outcomes of such behaviour, and improve the metabolic control of adolescents with T1DM, a greater understanding of this specific behaviour and the precipitating factors is needed. Such understanding might permit more effective screening and prevention strategies to minimise its use as part of a young person's repertoire for managing weight.

The aim of this review is therefore to critically review available research on the impact of weight-related concerns on diabetes-specific weight management practices, specifically the misuse or omission of insulin in adolescents with T1DM, in conjunction with the implications for health outcomes in this population. In doing this, the following questions will be explored:

- What evidence exists that weight-related concerns lead to insulin manipulation as a weight management strategy?
- Do those diagnosed with eating disorders engage in insulin manipulation to a greater extent than those without such a diagnosis?

- Is there evidence of specific health consequences of this behaviour? Does this differ with frequency/severity of use of insulin manipulation?

3.0 Method

Databases relevant to the review topic, PsycINFO, MEDLINE and CINAHL were searched in January 2010 using a keyword and MeSH heading search. These specific databases were chosen to ensure journals related to the field of psychology, allied health, medicine and healthcare were comprehensively searched. No additional databases were included to ensure unnecessary duplication of searches did not occur. Keywords included T1DM as a term in all searches. The aim of the review was to investigate insulin manipulation as a weight loss strategy. Terms initially used to scope the literature were: Insulin Omission, Insulin Misuse and Insulin Manipulation, all of which yielded very few results. The vast majority of research on insulin manipulation appears embedded in research investigating the prevalence of both clinical and sub-clinical eating disorders. Eating Disorders and Disordered Eating were therefore used as keywords separately to ensure the literature was interrogated for the insulin manipulation within both clinical and sub-clinical eating disorders. Additional salient keywords and MeSH headings identified from scoping review articles on diabetes and eating disorders were: Weight Control Practices, Weight Management, Weight-Related Concerns, Weight and Shape Concerns, Body Image, Body Dissatisfaction, Insulin Omission, and Insulin Misuse. A total of 504 articles were elicited. The term insulin manipulation will be used throughout the results as an umbrella term for insulin omission and misuse.

Once the database searches had been completed, the elicited abstracts were then scrutinised for suitable inclusion in the review, with articles excluded if they possessed one or more of the following exclusion criteria:

- Dissertation Abstracts
- Review articles/case reports/comments/chapters
- Irrelevant content (no inclusion of T1DM and eating disorders/disordered eating)
- Not written in English language

- Qualitative research
- No inclusion of participants with T1DM
- No inclusion of participants without an eating disorder
- No inclusion of participants in the adolescent age range (11-18 yrs)
- No analysis of prevalence of insulin omission as a weight management strategy
- Methodology that precluded sufficient comparison with other papers

Exclusion criteria were selected to ensure only quantitative original papers were included in the review, that were relevant to the review topic, with prevalences of insulin omission clearly investigated and stated. Papers were excluded where only participants with an eating disorder were included, as the review was not investigating a clinical sample. The exclusion criteria were selected to ensure that papers were able to address the research question whilst being sufficiently comparable for the results to be synthesised in a review. Two papers were excluded on the basis of their methodologies not allowing sufficient comparison with other papers. One paper removed participants exhibiting disordered eating behaviours at baseline. This paper was therefore removed as it would not have allowed sufficient comparison with other papers, due to the likelihood of reporting lower rates of insulin manipulation. The second paper did not sub-categorise purging behaviour, prevalence of insulin manipulation was therefore not clearly stated, resulting in comparison with other papers not being possible.

Application of exclusion criteria reduced abstracts by 490 (Appendix A), with two articles excluded because of methodological confounds. A total of 14 articles therefore remained; full papers were obtained and then subjected to critical review. Papers that appeared relevant to the research question but did not meet the criteria for inclusion were selected as contextual papers (Appendix A).

A data extraction tool was developed and utilised to review the content, methodology and empirical findings of the 14 remaining articles (Appendix B). Regarding methodology

and content, the following information was extracted: aims of research; dimension of the review question that was being investigated; design and method; method used to define disturbed eating behaviours; measures used and their reliability/validity (including their adjustment for use with diabetic populations); constituency and size of the sample; and the method of data analysis. Regarding empirical findings, the following data was extracted: prevalence of insulin omission; prevalence of insulin misuse; frequency/severity of insulin misuse; prevalence rates for participants with and without eating disorders; BMI measurements; motives for insulin manipulation; impact of weight/shape concerns; and health outcomes data, if available. The data extraction tool was designed to focus the critical appraisal on the relevant aspects of the review question, and to allow systematic critique and synthesis of the findings. Results of the data extraction are available in Appendix C.

Articles were not necessarily excluded from the review if they also contained data on individuals with Type 2 diabetes, or participants out-with the adolescent age range. However, only relevant sections of the articles were included in the results. Longitudinal papers were not excluded if baseline data with an adolescent population was reported. The follow-up information with adult participants was then used contextually.

4.0 Results

4.1 Overview of Findings

Six of the 14 papers (studies 7, 8, 11, 12, 13, 14) investigated the use of insulin manipulation as a weight loss strategy as a primary focus, usually in the context of other weight control behaviours. Three papers (studies 7, 8, 12) had variations of the term insulin manipulation in their title, thus explicitly investigating this behaviour. Of the remaining eight papers, insulin manipulation was investigated as a facet of a clinical or sub-clinical eating disorder (studies 1, 2, 3, 4, 5, 6, 9, 10). Six of the 14 (1, 3, 5, 7, 12, 13) papers paid some attention to the role of weight and shape concerns in the development of disturbed eating behaviours, with four (studies 1, 3, 5, 7) specifically looking at the role of weight and shape concerns in relation to insulin manipulation. Seven of the 14 papers (studies 2, 3, 5, 6, 9, 11, 12) considered the health implications of disturbed eating behaviours, with three of these papers (studies 3, 9, 12) investigating the contribution of insulin manipulation to health outcomes independently. Three of the 14 papers were longitudinal (studies 2, 3, 8) with the remaining 11 (studies 1, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14) having a cross-sectional design. Two were multi-centre studies (studies 6, 14).

4.2 Weight/Shape Concerns

Four papers examined specifically the role of weight and shape concerns in relation to insulin manipulation (studies 1, 3, 5, 7). Ackard, Neumark-Stainzer, Schmitz, Hanman, and Jacobs (2008) and Neumark-Stainzer et al. (2002) found that adolescents with T1DM and insulin omission were more likely to report body dissatisfaction, independent of BMI, and weight perception than their diabetic peers who did not engage in this weight loss strategy. Similarly, Peveler et al. (2005) reported a significant difference in Eating Disorder Examination (EDE) scores with regards to shape and weight concern between subjects with

and without a history of insulin misuse, independent of body weight. Khan and Montgomery (1996) reported that young female diabetics who omit insulin had levels of Drive for Thinness on the Eating Disorders Inventory (EDI) that were above the clinical cut-off, and exhibited increased concern about their bodies at a younger age than controls. A contradictory finding was reported by Howe, Jawad, Kelly and Lipman (2008), who found no significant difference in rates of insulin omission and misuse between those who were and were not satisfied with their bodies. Their rate of reported insulin manipulation was, however, much lower than several other reports at 1%, which may account for the lack of a significant difference.

4.3 Prevalence of Insulin Omission/Misuse

4.3.1 Overview of methodology.

The methodologies of the 11 papers investigating prevalence of insulin manipulation using a cross-sectional design are described (studies studies 1, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14). Ten of the 11 papers accessed participants from local diabetic centres (studies 1, 4, 5, 6, 7, 9, 10, 11, 12, 13), and used similar exclusion criteria, including: participants who had been diagnosed with T1DM for less than a year; participants who were pregnant or lactating; a lack of fluency in English; and developmental delay. The remaining paper recruited participants from SEARCH (SEARCH for Diabetes in Youth, 2004) (study 14), and is a multi-centre study conducting population-based ascertainment of youth with clinically diagnosed diabetes. Six of the papers utilised a self-report survey design (studies 1, 5, 7, 8, 12, 14). Self report measures varied, and included: the Assessing Health and Eating among Adolescents with Diabetes (AHEAD) Survey, Project Eating Among Teens (Project EAT) Survey, the Diabetes Eating Problem Survey (DEPS), the Eating Disorders Inventory (EDI), the Eating Attitudes Test (EAT-26), the Dutch Eating Behaviour Questionnaire (DEBQ), and the Youth Risk Behaviour Surveillance System. The remaining eight papers (studies 2, 3, 4, 6, 9, 10, 11, 13)

utilised a diagnostic interview, with six papers using the standard EDE (studies 3, 6, 9, 10, 11, 13), and the other two utilising the children's version of the Eating Disorders Examination (cEDE) (studies 2, 4). Researchers often modified the cEDE/EDE for use with a diabetic population by including questions about attention to food portions that may be related to diabetes management. Only one paper used the validated modified version of the EDE, the Eating Disorders Examination-Diabetes (EDE-D) (study 13). The Semi-Structured Symptom-Oriented Interview Schedule for Children and Adolescents (HSC) was also used on one occasion (study 8). For self-report survey designs, participants were usually recruited via mail, and participants also completed and returned their surveys using the postal system, or at their regularly scheduled out-patient appointment. For the papers that utilised a diagnostic interview, participants were usually recruited at their regularly scheduled out-patient appointments and completed the interview in a private space shortly after or before their diabetic appointment. Other measures, such as height and weight, and HBA_{1C} were also collected at these clinics. Some of the papers invited patients to participate in the research through invitation letter to home address, and then conducted the interviews in the community.

Longitudinally designed papers often utilised similar methodologies, with a repeated administration of measures at follow-up. Colton et al. 2007 utilised the cEDE, and re-administered this after a 1 year interval. Peveler et al. 2005 re-interviewed participants using the EDE 8-12 years after baseline interview. Pollock, Kovacs, & Charron-Prochownik (1995) utilised the HSC and repeatedly re-interviewed participants over an interval of up to 14 years.

4.3.2 Findings.

All 14 articles found evidence of the practice of insulin manipulation for weight control or loss (Table 1). Seven of the 14 articles studied female participants only (studies 2,

3, 4, 6, 7, 11, 13). Reported prevalence varied, and ranged from 1% to 37% within the samples. Of the studies that investigated both insulin omission and reduction, omission seemed to be utilised more widely than reduction (Ackard et al., 2008; Neumark-Stainzer et al., 2002; Kichler, Foster, & Opipari-Arrigan, 2008), but reasons for this discrepancy did not appear to be investigated. The ease of omission over reduction, coupled with the greater effectiveness of omission for weight loss, may account for the increased prevalence.

Variability of results may be attributable to a number of factors. Of the studies that utilised both females and males, only Ackard et al. (2008) documented separate prevalence rates for males and females, revealing female adolescents utilised the strategy to a greater extent. The studies that drew on a mixed sample may therefore have artificially lowered prevalence rates due to the inclusion of male participants.

Comparison of prevalence rates across papers was made problematic given that definition of insulin manipulation varied, from omission and reduction of insulin dose, omission of insulin only, to reduction of insulin dose only. Papers varied considerably in the frequency/severity of insulin manipulation required to occur before attaining a threshold for inclusion in the study, ranging from seven papers including use at least once across a lifetime or once in past year (studies 1, 3, 5, 10, 11, 12, 14) as a weight loss strategy, to seven papers stipulating a level of more frequent use, for example, omission of insulin on a daily basis (studies 2, 4, 6, 7, 8, 9, 13). Variability also existed regarding whether the insulin manipulation was included as a current or past weight loss strategy.

The rationale for deciding the threshold level of insulin manipulation for inclusion seemed to be dictated by the method of classifying disturbed eating behaviour. Those studies reliant on DSM criteria often only included severe or frequent levels of manipulation, whereas others using less stringent classification systems included significantly less frequent or less

severe levels of manipulation, affecting detected prevalence rates. As will be discussed in further detail, the samples across the 14 papers are not exclusively non Eating-Disordered samples. The presence of participants with a diagnosis of an Eating Disorder in the sample is likely to increase the prevalence of insulin manipulation as a weight loss strategy.

Table 1: Prevalence of insulin manipulation

ID	Prevalence of insulin omission	Prevalence of insulin misuse (reduction)	Prevalence of insulin manipulation (omission and reduction combined)
1	10.3% females, 1.4% males	7.4% females, 1.4% males	-
2	-	-	1% females
3	-	-	36% females
4	-	-	2% females
5	10.3% mostly females	7.4% mostly females	-
6	-	11% females	-
7	22.9% females	-	-
8	-	-	7.6% females and males
9	-	-	15% females and males
10	-	-	37% history/11% currently females and males
11	-	-	12% history females
12	1.4% females and males	1% females and males	
13	30.7%/12%/9.3% (depended on frequency) females	13.3%/5.3%/4% (depended on frequency) females	
14	-	-	4.2% females and males

Considering the impact of age on the prevalence rates of insulin manipulation, a reduction in the occurrence of insulin manipulation as a weight loss strategy is revealed when participants in the pre-teen years are included (Table 2). Colton et al. (2004;2007) reported a prevalence rate of 1% and 2% respectively when utilising a sample comprising 9-13 year old females, whereas Fairburn et al. (1991) noted a prevalence of 30.7% in a sample of 17-25 year olds. In a longitudinal study, Colton and colleagues (2007) reported that disturbed eating behaviour persisted but did not appear to worsen over a one year period. They did not,

however, specifically determine variability in insulin manipulation longitudinally. It is therefore difficult to draw conclusions about the development of insulin manipulation as a weight loss strategy across the adolescent period when there are numerous other factors that could account for the difference in prevalence rates reported.

An additional confounding variable is the reporting of average descriptive statistics. Longitudinal studies, such as Peveler et al. (2005) and Pollock et al. (1995), report an overall prevalence of insulin manipulation in all their samples which may inflate results as an artefact of including participants in the late adolescent and early adult age ranges.

Table 2: Prevalence of insulin manipulation according to age of participants

ID	Prevalence of insulin omission	Prevalence of insulin misuse (reduction)	Prevalence of insulin manipulation	Age of participants
1	10.3%/1.4%	7.4%/1.4%	-	12-21
2	-	-	1%	9-13
3	-	-	36%	11-18/17-25 at baseline
4	-	-	2%	9-13
5	10.3%	7.4%	-	12-21
6	-	11%	-	12-19
7	22.9%	-	-	13-20
8	-	-	7.6%	8.2-13.8
9	-	-	15%	11-18
10	-	-	37% past/11% currently	17-25
11	-	-	12% history	13-18
12	1.4%	1%	-	Mean age 14.9
13	30.7%/12%/9.3%	13.3%/5.3%/4%	-	11-17
14	-	-	4.2%	Mean age 15

As mentioned previously, the eating disorder status of the sample appears to have an impact on reported use of insulin manipulation as a weight loss strategy (Table 3). When participants with a diagnosable eating disorder are included in a sample this tends to increase

the prevalence of insulin manipulation. Papers that have provided separate reports of the use of insulin manipulation for participants with and without eating disorders confirm this. Jones et al. (2000) report a prevalence of 42% for participants with an eating disorder, 18% for those with sub-threshold disorders, and 6% for those without an eating disorder. Rodin et al. (1991) reported a similar finding, along with Peveler et al. (2005) who reported a difference in the use of insulin manipulation between those participants with and without a history of disordered eating. For papers not assessing diagnosable eating disorders, there may well have been participants that the researchers were unaware of in the sample who would meet the criteria for a DSM Eating Disorder diagnosis. Comparisons between samples that are not exclusively non-eating disordered therefore need to be treated with caution.

Table 3: Prevalence of insulin manipulation according to eating disorder status of sample

ID	Prevalence of insulin omission	Prevalence of insulin misuse (reduction)	Prevalence of insulin manipulation	Exclusively non-eating disordered sample?	Sample composition
1	10.3%/1.4%	7.4%/1.4%	-	Not investigated	-
2	-	-	1%	Yes	No diagnosis of AN/BN in sample
3	-	-	36%	No	61% -History of disordered eating 26%- No history
4	-	-	2%	No	Some participants had a diagnosis of EDNOS
5	10.3%	7.4%	-	Not investigated	
6	-	11%	-	No	42% with ED. 18% sub-threshold. 6% non-eating disordered group
7	22.9%	-	-	Yes	
8	-	-	7.6%	Yes	
9	-	-	15%	No	One had ED
10	-	-	37% past/ 11% currently	No	4 of 6 participants who omitted insulin had an eating disorder
11	-	-	12% history	No	54% with ED 6% without ED
12	1.4%	1%	-	Not investigated	
13	30.7%/12%/ 9.3%	13.3%/5.3% /4%	-	Not investigated	
14	-	-	4.2%	Not investigated	

4.4 Health outcomes related to use of insulin omission/misuse

Three of the 14 papers investigated the independent contribution of insulin manipulation to health outcomes (studies 3, 9, 12). Peveler and colleagues' (2005) longitudinal study reported that 48% of participants who developed serious micro-vascular complications had a history of insulin misuse, with a significant relationship between the

latter and the presence of two or more serious complications, as well as a strong relationship to hospital admissions with DKA. The remaining two studies adopted a cross-sectional design and investigated metabolic control as opposed to long term health outcomes. Howe et al. (2008) reported that those who omitted insulin doses had significantly higher HBA_{1C} measurements and Peveler et al. (1992) similarly found that those who omitted insulin had poorer glycaemic control than those whose adherence was satisfactory.

5.0 Discussion

5.1 Overview of Research

The review aimed to critically appraise research examining the impact of weight-related concerns on diabetes-specific weight management practices, specifically the misuse or omission of insulin in adolescents with T1DM, along with the implications for health outcomes in this population.

The use and development of insulin manipulation as a weight loss strategy, to date, has not been given adequate attention as an independent entity. Knowledge about this behaviour appears limited to data on prevalence rates, for which there is little agreement, other than that manipulation exists to varying degrees in those with and without clinical eating disorders. As a method of weight control it has been investigated in the context of other behaviours associated with diagnosable and sub-clinical eating disorders, and as a consequence, the understanding of insulin manipulation as a health phenomenon in its own right is limited, therefore, extrapolating to clinical contexts is difficult.

Specific questions were addressed in relation to this review, and each will now be discussed in relation to the findings.

5.1.1 The role of weight-related concerns.

Four of the 14 papers specifically addressed the impact of weight and shape concerns on the development of insulin manipulation as a weight loss strategy, with three papers identifying an association between weight and shape concerns, or body dissatisfaction, and the use of insulin manipulation.

From the available research, it remains unclear what mechanisms are operating in transforming weight-related concerns into insulin manipulation for the purposes of weight loss/control. There are numerous remaining questions, including whether weight-related

concerns solely determine the development of insulin manipulation, or whether they need to exceed a certain threshold for insulin manipulation to emerge as a weight loss strategy. It is unclear whether other factors interact with weight-related concerns to trigger the use of this behaviour, and how weight-related concerns develop over time.

Without adequate answers to these questions, it becomes a difficult clinical task to know when and how to screen for, and intervene effectively with, this risky behaviour.

5.1.2 The impact of diagnosis of an eating disorder.

Unsurprisingly, insulin manipulation as a weight loss strategy is more readily utilised in individuals with a diagnosable eating disorder. Having a mixed sample of participants with and without eating disorders is likely to artificially increase prevalence rates for this behaviour. It remains unclear whether the factors that are involved in the development of this behaviour are the same for individuals with and without eating disorders, posing significant difficulties for the clinician.

5.1.3 Development of insulin manipulation over time.

The findings suggest that insulin manipulation does develop as a weight loss strategy through adolescence and into adulthood. Colton et al. (2004; 2007) reported the lowest prevalence rates at 1% in their samples of 9-13 year olds, whereas Fairburn et al. (1991) noted a prevalence of 30.7% in a sample of 17-25 year olds. Peveler et al. (2005), in a longitudinal study, noted an accumulation of insulin manipulation from adolescence to young adulthood. The majority of papers utilised means and a wide age range in their sample, such as 12-21 years in Neumark-Stainzer et al. (2002), potentially obscuring age and the cognitive and maturational factors contributing to effects. Research with non-diabetic populations has shown a rising prevalence of purging behaviours in the teenage years, (Field et al., 1999;

Neumark-Stainzer & Hannan, 2000). A greater number of longitudinal studies are warranted to understand how this weight loss strategy develops within individuals with T1DM.

5.1.4 Health outcomes.

The health outcomes associated with co-morbidity of eating disorders and T1DM have been well documented. The use of insulin manipulation as a weight loss strategy is also associated with poor health outcomes. In a longitudinal study, Peveler et al. (2005) reported an association of microvascular complications, hospital admissions and DKA with a history of insulin misuse. The use of cross-sectional designs has also highlighted an association between insulin manipulation and elevated HBA_{1C} measurements (Howe et al., 2008; Peveler et al., 1992). Two papers were excluded from the review due to not utilising an adolescent sample; however, although not scrutinised in this review, their findings are of interest as they document the long-term health consequences of insulin manipulation. Goebel-Fabbri et al., (2008) reported that women utilising insulin restriction at baseline were more likely to experience nephropathy and foot problems at follow-up, over an 11 year period, with self-reported insulin manipulation also increasing the relative risk of death. Similarly, Bryden et al. (1999) reported 46% of participants who had developed microvascular complications had deliberately misused their insulin, suggesting a link between insulin manipulation and poor long-term health outcomes. Worryingly, this is likely to be an under-representation due to the under-reporting of insulin manipulation, as an inappropriate adherent behaviour.

Empirical evidence documenting the long-term health consequences of insulin manipulation is sparce. The specific role of insulin manipulation in poor health outcomes requires refinement and further delineation. Currently, the answer to an important clinical question ‘what level of insulin manipulation is a cause for concern?’ is not known. It is pertinent that this answer is ascertained, to allow adequate and effective screening and treatment to take place.

In addition, the term ‘insulin manipulation’ has several negative connotations, including the suggestion that individuals are deliberately compromising their metabolic control to meet their own weight loss needs. There are a variety of factors that could contribute to ‘insulin manipulation’, including lack of knowledge, an external locus of control and psychological and emotional distress, all of which may limit an individual’s capacity to regularly administer their prescribed dose of insulin. The pejorative nature of such a term is likely to increase feelings of shame in individuals who are struggling to manage their diabetes, and is therefore likely to negatively impact reporting to clinicians, thereby limiting the clinician’s ability to intervene and empower the individual with T1DM to exhibit greater control over their diabetes management. It is important for clinicians to consider how an atmosphere of honest reporting, yielding a supportive rather than punitive response is most effectively adopted.

5.2 Limitations

The findings of the 14 articles critiqued and synthesised in this review have been discussed. Several notes of caution require further comment before their findings are accepted as robust evidence for the existence of insulin manipulation as a weight management strategy in individuals with T1DM.

Evidence to date has a number of key limitations as discussed previously. However there are further vulnerabilities of note. Operationalisation and classification of the term ‘insulin manipulation’ can have implications for the conclusions drawn from the findings, with research varying depending on whether insulin manipulation is regarded as a component of an eating disorder, or a sub-clinical disordered eating behaviour. Terminology and classification can dictate the method used to identify the behaviour under investigation, and the levels which are set for detection of such behaviour, for example DSM-driven diagnostic interviews, often more robust for diagnostic purposes, investigate levels above pre-determined

clinical thresholds. Self-report measures, predominantly questionnaires, however, are used primarily to detect lower threshold, sub-clinical levels. As a consequence, often higher levels of engagement in insulin manipulation and other unhealthy weight management behaviours are detected (Fairburn et al., 1991).

Methodologies employed in the research tend to be dichotomous, using either interview or self-report questionnaire. The methodologies provide differing levels of anonymity and sensitivity, with interviews offering greater sensitivity to detect problematic behaviours. The lack of anonymity present in an interview may, however, cause under-reporting of insulin manipulation. Honest reporting of insulin manipulation may therefore be compounded by the methodology employed to investigate it, particularly how anonymity is preserved for the participant within this methodology (Howe et al., 2008).

Researchers often utilised wide age ranges, and rarely employed developmental markers. A wide variation, therefore, exists in self-concept and body image development across the samples. Levels of body dissatisfaction, and therefore disturbed eating behaviour, are likely to be more prevalent as individuals develop body image to a greater extent. The role of T1DM in the development of weight control behaviours, such as insulin manipulation, is therefore difficult to ascertain without considering the developmental stage of the individuals.

Research in this area can attract a low response rate, for example 38% (Howe et al., 2008) and 58% (Ackard et al., 2008; Neumark-Stainzer et al., 2002). It is likely that differences exist between responders and non-responders. The shame associated with disclosing behaviours associated with disturbed eating behaviour may suggest that non-responders are potentially more likely to be engaging in higher levels of disturbed eating behaviours than those who volunteer to take part in the study (Beglin & Fairburn, 1992). Ackard et al. (2008) and Colton et al. (2004) noted that those who participated in their

research were in better metabolic control than those who did not participate, as indicated by their HBA_{1C} levels, suggesting that non-responders were potentially engaging in higher levels of unhealthy weight control behaviours than responders. The level of insulin manipulation currently reported may therefore be artificially low.

With the exception of multi-centre studies, including Jones et al. (2000) and Lawrence et al. (2008), research in this area often utilises relatively small sample sizes of adolescents with T1DM, which therefore yields limited power to detect differences between groups. In addition, only half of the papers reviewed utilised a control group, which significantly lowers the generalisability of the findings. Papers utilising a longitudinal design also run the risk of losing participants displaying disturbed eating behaviours at follow-up, potentially artificially lowering the long-term prevalence of behaviours, such as insulin manipulation (Peveler et al., 2005). The possibility of selection biases within samples can also not be ruled out. Many of the papers accessed their participants from paediatric diabetic clinics, which are not entirely population-based samples, as referral biases may exist (Jones et al., 2000).

The use of a majority of cross-sectional designs in this area (11 of the 14 papers in this review) does not allow the temporal order of weight/shape concerns, use of insulin manipulation and clinical outcomes to be determined. A greater proportion of longitudinal research is therefore warranted to determine these associations, knowledge of which would allow appropriate, effective interventions to be undertaken.

Psychological risk factors of depression and low self-esteem for eating disturbances have been identified in the general population (Vogeltanz-Holm et al., 2000), however, only Colton et al. (2007) included a measure of depression and self-worth in their research. Pollock et al. (1995) also reported that those who had ‘eating problems’ in their sample were more likely to have a DSM III psychiatric disorder than controls. For the majority of research in

this area it is therefore impossible to determine the sole and unique contribution of weight/shape concerns in mediating the use of insulin manipulation.

5.3 Clinical Implications

Despite the limitations of the research, it is clear that engaging in insulin manipulation has serious clinical implications. Insulin manipulation has been associated with increased HBA $_{1C}$ levels, as well as increased risk of DKA, hospital admissions, and long-term health consequences, such as retinopathy and nephropathy. It is important that detection and intervention of this behaviour is improved in the clinical setting, and is considered in individuals in the pre-adolescent age range. Insulin manipulation tends to increase as individuals develop throughout late adolescence and early adulthood and becomes a more entrenched behaviour. If preventative measures can be employed, the use of insulin manipulation as a weight loss strategy, and consequently, detrimental health outcomes, may be reduced in adolescents. Preliminary evidence (Olmsted, Daneman, Rydall, Lawson, & Rodin, 2002; Olmsted et al., 2002) suggests that interventions directed towards disturbed eating behaviour in girls with T1DM may help ameliorate early disturbances.

5.4 Future Research

Future research should be directed towards investigating insulin manipulation as an independent health phenomenon, with a move away from the association with clinical and sub-clinical eating disorders. A model of predictors of insulin manipulation, including age of onset, is warranted in order to design interventions effectively. Defining the level of insulin manipulation that determines long-term health outcomes requires further research to allow screening and interventions to be targeted at the appropriate level. The association of insulin manipulation with other self-care behaviours also requires definition.

Insulin manipulation is often investigated in relation to body dissatisfaction or BMI. While these are important mediating variables, variables which are associated with barriers to effective treatment adherence, such as psychological distress, diabetes-specific distress, body image, and fear of hypoglycaemia are also likely to be instrumental. Currently the influence of these additional constructs has not been investigated, making our knowledge associated with the motives for engaging in such behaviour limited.

Implications for health care professionals working with this population also warrant further investigation, with particular focus on how the subject of insulin manipulation is broached with patients. Patients are likely to experience a fear of judgment in relation to reporting non-adherence with the diabetes regimen, which is likely to be heightened by parents often being present at clinic appointments. How honest reporting that is not met by judgement can be maximised in clinics warrants further investigation, to allow effective screening and prevention to take place.

5.5 Conclusions

The use and development of insulin manipulation as a weight loss strategy, to date, has not been given adequate attention as an independent entity, as a consequence, the understanding of insulin manipulation as a health phenomenon in its own right is limited.

The research highlights that an association appears to exist between weight and shape concerns and the use of insulin manipulation. Insulin manipulation is a behaviour which is engaged in more by those with diagnosable eating disorders, and appears to be utilised more by those in the older adolescent development period. Insulin manipulation is associated with poor health outcomes, including elevated HBA_{1C} measurements, microvascular complications, DKA, nephropathy and retinopathy.

Factors involved in the transformation of weight-related attitudes into weight loss behaviours, such as insulin manipulation, warrant further investigation. A greater number of longitudinal studies are also required to understand how this weight loss strategy develops within individuals with T1DM, and what the long-term health consequences of this behaviour are.

Despite the limitations of the research, it is clear that engaging in insulin manipulation has serious clinical implications. If preventative measures can be employed, the use of insulin manipulation as a weight loss strategy, and consequently, detrimental health outcomes, may be reduced in adolescents.

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Research Paper: The mediating role of appearance-related schema in the pattern of eating attitudes and behaviour in adolescents with Type 1 Diabetes.

1.0 Abstract

Introduction

Adolescent girls with diabetes mellitus appear to present with a twofold increased risk of developing an eating disorder than their non-diabetic peers (Jones, Lawson, Daneman, Olmsted, & Rodin, 2000), and are 1.9 times more likely to develop a sub-threshold eating disorder (Jones et al., 2000). Individuals with T1DM also have at their disposal the use of insulin omission, a unique form of calorie purging behaviour, often referred to as *diabulimia*.

A number of potential risk factors for the development of disordered eating have been advanced, including; low self-esteem, impaired self-concept development, body dissatisfaction, higher Body Mass Index, dietary restraint, and depression. The cognitive components of body image, rather than the specific attitudinal area of body dissatisfaction have been neglected areas, and were specifically addressed in this research.

The aims and objectives of this research were to investigate the mediating role of appearance-related schema in the pattern of eating attitudes and behaviours in adolescents with T1DM.

Method

The study utilised a quantitative independent between groups design, with two groups - comprising adolescents (11-18) living with T1DM, and non-diabetic controls. The clinical sample of 52 was sought from acute NHS trusts within the Midlands, with 61 controls sought from secondary schools.

The following measures were utilised; The Children's Eating Attitudes Test (ChEAT), the Appearance Schemas Inventory Revised (ASI-R), the Children's Depression Inventory (CDI), the Rosenberg Self-Esteem Scale (RSES), and the Diabetes Eating Problem Survey (DEPS) administered only to the clinical sample. Further demographic information was also obtained.

Results

There were no significant between-group differences with regards to age, gender or ethnicity. All measures, with the exception of the DEPS, exceeded the acceptable minimum of reliability - 0.7 (Devellis, 2003), the DEPS was therefore removed from the study and not subject to further analysis.

Adolescents living with T1DM did not display significantly more disordered eating attitudes, or have higher investment in body image for self-definition than adolescents living without T1DM. Investment in body image for self-definition was not significantly predictive of eating attitudes and behaviours for adolescents living with and without T1DM. Self-esteem was a significant predictor of eating attitudes, applying only to the control group.

Conclusions

The impact of appearance-related schema requires further investigation with a clinical sample exhibiting disordered eating attitudes and behaviour. If empirical support was gained for the role of appearance-related schema in the development and maintenance of disordered eating attitudes and behaviour, this research has shown the ASI-R is a reliable measure when used with an adolescent population, and may therefore be a clinically useful screening tool.

2.0 Scientific Background

2.1 Type 1 Diabetes in Adolescence

Type 1 diabetes mellitus (T1DM) is an autoimmune disease resulting in the destruction of the insulin-producing beta cells of the pancreas. Without insulin, the cells of the body are unable to utilise the glucose in the blood, resulting in death, unless treated with exogenous insulin. Insulin is usually administered via injection, or pump. T1DM is one of the most common chronic conditions of childhood and adolescence (Drash, 1987). Metabolic control, i.e. the balance between production and utilisation of glucose, requires adherence to a treatment regimen, including multiple daily insulin injections, blood sugar measurements and meal planning. Generally, metabolic control deteriorates in adolescents with T1DM compared to younger children and adults (Mortensen et al., 1998).

2.2 Metabolic Control

The emergence of eating disorders in the adolescent and early adult developmental stages has been suggested as having a contributory role in non-adherence to the treatment regime, and the consequent deteriorating metabolic control in adolescents with T1DM. Adolescent girls with T1DM present with a twofold increased risk of developing an eating disorder than their non-diabetic peers (Jones, Lawson, Daneman, Olmsted, & Rodin, 2000), with the application of DSM criteria highlighting approximately 10% of adolescent diabetics are diagnosable with an eating disorder (Fairburn, Peveler, Davies, Mann, & Mayou, 1991; Peveler, Fairburn, Boller, & Dunger, 1992; & Affenito et al., 1997).

2.3 Eating Disorders and T1DM

A number of perspectives have been advanced to explain why individuals with T1DM are at a higher risk of developing eating disorders than their non-diabetic peers (Popkin, 1989; Rodin & Daneman, 1992; Hall, 1997), however, a lack of agreement currently exists between

these explanatory models. T1DM has been suggested as having a role in the path of an adolescent's developmental trajectory, potentially leading to low self-esteem and impaired self-concept development (Hauser, Jacobson, Noam & Powers, 1983; Jacobson et al., 1986). Diabetes may have an additional role in exposing adolescents to additional risk factors associated with the development of eating disorders, including, body dissatisfaction (Jones et al., 2000), higher Body Mass Index (Domargard, Sarnblad, & Kroon, 1999), dietary restraint (Daneman, Olmsted, & Rydall, 1998), depression (DeGroot, Anderson, & Freedland, 2001) and low self-esteem (Collon, Olmsted, & Daneman, 2007). Based on the available research, Goebel-Fabbri, Fikkan, and Connell (2002) proposed the following model of eating disorders in T1DM (Figure 1).

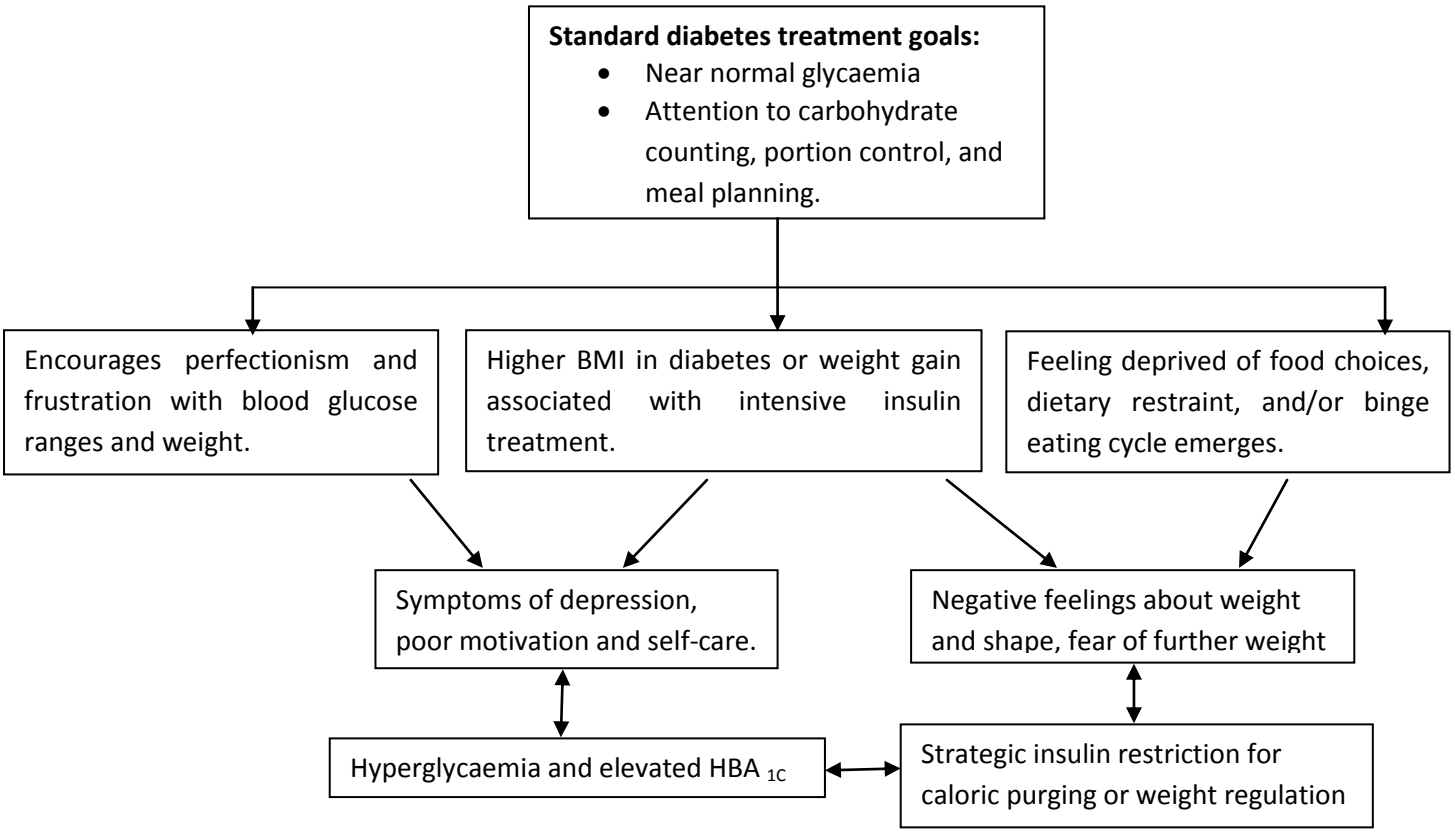

Figure 1. Model of eating disorders in T1DM.

2.4 Sub-Clinical Eating Disturbances and T1DM

Sub-clinical disturbed eating behaviour (behaviour consonant with eating disorder symptoms not at the level or frequency to merit a formal diagnosis), includes: dietary restriction, binge eating, self-induced vomiting, laxative/diuretic use, excessive exercise, or insulin restriction in the case of individuals with T1DM.

Sub-clinical disturbed eating behaviours are common amongst adolescent girls (Olmsted, Colton, Daneman, Rydall, & Rodin, 2008), with those with T1DM more likely to exhibit two or more disturbed eating behaviours than their non diabetic peers (Colton, Olmsted, & Daneman, 2004). Sub-clinical disturbed eating behaviours have been shown to persist and increase in severity over time (Peveler, Bryden, & Neil, 2005; Colton et al., 2004), with an association existing with the development of clinical Eating Disorders (Striegel-Moore & Bulik, 2007).

2.5 The role of Insulin Omission

Insulin omission is a unique form of calorie purging behaviour. When less insulin is taken than is required, patients induce hyperglycaemia and glycosuria. This results in impaired glucose utilisation, with fat and muscle stores being degraded to produce an alternative source of energy.

This unique form of calorie purging behaviour tends to rise during adolescence, with 1% reporting in the preteen years (Colton, Daneman, Olmsted, & Rodin, 2000), 11-14% in the mid-teen years (Jones et al., 2000), and 34% in older adolescents and young adults (Rydall, Rodin, Olmsted, Devenyi, & Daneman, 1997). It has been suggested that insulin omission is weight - or eating - related, rather than being associated with more general concordance difficulties with diabetes management, as it is often utilised to a greater degree in

individuals with a diagnosable eating disorder (Rodin, Craven, Littlefield, Murray & Daneman, 1991).

2.6 Predictors of Eating Disturbances and Body Dissatisfaction in T1DM

The following predictors of eating disturbances in adolescents with T1DM have been highlighted: higher BMI, depression, low self-esteem with the addition of attention to dietary restraint (Colton et al., 2007), concerns with weight and shape, and lower self-esteem related to physical appearance (Olmsted et al., 2008). Concerns with weight and shape, or body dissatisfaction have been shown to be predicted by higher BMI (Thompson & Smolak, 2001), however, adolescents with T1DM often report higher levels of body dissatisfaction independent of actual BMI (Ackard et al., 2008; Neumark-Stainzer et al., 2002; Peveler et al., 2005). Currently, there is a dearth of evidence on what else may mediate the link between T1DM and body dissatisfaction. The perceptual and cognitive components of body image, rather than the specific attitudinal area of body dissatisfaction, certainly appear to be neglected areas.

2.7 Body Image

In combination with female sex and body size, the later adolescent development period, a time when body image is of particular concern, is predictive of the development of disordered eating in both healthy individuals and those with diabetes (Engstrom et al., 1999; Meltzer et al., 2001; Neumark-Stainzer et al., 1996). The development of body image is influenced by pubertal development, involving weight gain, and increase in adipose tissue, especially for girls. As many as 40-70% of adolescent girls in the general population report being dissatisfied with two or more aspects of their bodies, with 12-15 being a specific age range when body dissatisfaction appears to increase. The timing of puberty appears to be an important predictor of body dissatisfaction for adolescent girls, with earlier pubertal onset

associated with the development of negative body images (Siegel, Yancey, Aneshensel, & Shuler, 1999).

Marked gender differences have been shown between the body images of adolescent boys and girls. Adolescent girls tend to have a more differentiated body image, evaluating their bodies in terms of more parts, and having greater negative evaluations of such parts. In a meta-analysis, Feingold and Mazzella (1998) noted an increase between the 1970's and 90's of adolescent girls', but not boys', tendency to report a negative body image.

Body image, the psychological experience of embodiment, is a multidimensional phenomenon, comprising self-attitude toward one's body, particularly its size, shape and aesthetics (Cash & Pruzinsky, 2002). Body image development is an important psychological and interpersonal task of adolescence. It can be argued that body image is one of the most important components of an adolescent's global self-esteem, and has also been correlated with depression (Siegel et al., 1999).

Body image disturbances comprise perceptual and attitudinal components. The attitudinal component comprises an affective/evaluative dimension along with a cognitive-behavioural dimension or investment in body image, with the perceptual component involving inaccurate judgments of body size. Body image disturbances in the affective/evaluative dimension result in body dissatisfaction, whereas cognitive-behavioural disturbances result in over-evaluation of appearance and excessive effort devoted to the management of appearance (Cash, Melnyk, & Hrabosky, 2004).

Early research on eating disorders focused on the perceptual component (Slade & Russell, 1973). Whilst body image is still regarded a multidimensional construct, the focus shifted from the perceptual to the attitudinal component during the 1980s and 1990s. Perceptual methods of assessing body image disturbance lost favour in the 1990's as

investigators noted that size overestimation and dissatisfaction with size were not highly correlated (Thompson & Dolce, 1989). The most commonly measured attitudinal component of body image is body size dissatisfaction. Body dissatisfaction as an attitudinal component of body image has been investigated in adolescents with T1DM in a number of studies (Ackard et al., 2008; Peveler et al., 2005; Neumark-Stainzer et al., 2002; Khan & Montgomery, 1996; Howe, Jawad, Kelly, & Lipman, 2008; Lawrence et al., 2008), however, to date, cognitive aspects of body image have been neglected in the field of disordered eating in adolescents with T1DM.

The cognitive domain of body image comprises beliefs, thoughts and attributions. A pioneering cognitive measure is the Appearance Schemas Inventory-Revised (ASI-R) developed by Cash et al. (2004), which measures the degree of dysfunctional cognitive schema relating to appearance. The measure addresses multiple domains, including self-attentional focus, emotional/identity investment in appearance, beliefs concerning historical or developmental influences, beliefs related to interpersonal issues, and internalisation of social stereotypes regarding appearance.

The ASI-R includes two subscales, Self-Evaluative Salience (SES) and Motivational Salience (MS). SES measures the extent to which self-concept and self-worth are based on physical appearance, as well as beliefs that appearance is instrumental in social and emotional experiences (Cash et al., 2004). The MS subscale assesses attitudes and behaviours that relate to an individual's efforts directed at improving or maintaining certain aspects of physical attractiveness (Cash et al., 2004). A distinction can be made between the SES and MS subscales, in that the later may not be problematic if the goal is to care for appearance whilst not assuming that appearance is instrumental to self-worth. Empirical evidence supports the SES-MS distinction that self-evaluative salience is associated with more psychological and

body image disturbance than is motivational salience (Cash et al., 2004; Cash, Jakatdar, & Williams, 2004; Melnyk, Cash, & Janda, 2004; Rudiger, Cash, Roehrig, & Thompson, 2007).

Within cognitive models of body image, research increasingly focused on the role of schema, with a particular focus on self-schema. Cognitive schema refers to stored knowledge structures that interact with environmental cues in shaping attention, memory and thought (Segal, Gemar, Truchon, Guirguis, & Horowitz, 1995; Williams, Watts, MacLeod, & Matthews, 1998). Their exploration in the context of body image began with Markus in 1997, examining how information about the self is processed. Markus described self-schemas as "cognitive generalisations about the self, derived from past experience, that organise and guide the processing of self-related information contained in an individual's social experience" (p. 64). Cash's cognitive perspective on body image maintains that contextual events activate schematic, investment-driven processing of self-evaluative information about appearance which drives body-image affective experiences (Cash, 1994; Cash & Grant, 1996). An individual who is schematic for a self-definition will process information relevant to that dimension differently from someone who is aschematic, such that appearance-schematic individuals will place more importance on, and pay more attention to, and preferentially process, appearance-related information (Cash & Labarge, 1996).

Eating disorders pose grave medical complications, with as many as 18% of individuals diagnosed with an eating disorder dying due to medical complications (Patton, 1988; Theander, 1985). Current therapeutic interventions for individuals with eating disorders focus on the self-concept deviations thought to be central to the conditions (Bruch, 1973). This often includes challenging beliefs about one's appearance and weight utilising a cognitive behavioural therapeutic model (Beck, 1979). Such therapeutic interventions have been empirically supported and recommended for treatment (National Institute for Clinical Excellence [NICE], 2004).

2.8. Health Outcomes and Clinical Implications of Disordered Eating Behaviours for Individuals Living with T1DM

Short-term complications such as diabetic ketoacidosis (DKA), and long-term microvascular complications affecting the eyes, kidney and peripheral nerves can occur when optimal metabolic control is not achieved over a period of years (Diabetes Control and Complications Trial, 2000). Intentional insulin restriction/omission, and consequent inducement of hyperglycaemia and glycosuria, produces ketone bodies, resulting in DKA and the shift in the body's pH balance, expediting acutely life threatening consequences (Kahn, 1994).

Co-morbidity of T1DM and eating disorders is known to compromise metabolic control. Haemoglobin A_{1C} (HBA_{1c}) levels of individuals with T1DM and eating disorders may be two or more percentage points higher than their non-diabetic peers, with higher rates of hospital admissions, and increased risk of microvascular complications, such as neuropathy and retinopathy (Rydall et al., 1997; Bryden Neil & Mayou, 1999). Insulin restriction alone appears to increase mortality risk three fold (Goebel-Fabbri, Franko & Pearson, 2008), and worryingly disordered eating status was, in fact, more predictive of diabetic retinopathy at follow up than the duration of diabetes itself, a well established risk factor (DCCT, 1993). The presence of sub-clinical eating disturbances can also have significant consequences for metabolic control, as well as diabetic related complications (Khan & Montgommery, 1996; Rydall et al., 1997). There is corroboration from findings that girls with new onset of disturbed eating behaviours had poorer metabolic control, suggesting that mild and relatively new disturbances in eating can have a significant impact (Olmsted et al, 2008).

2.9. Aims and Objectives

Research has grown over the last two decades, since initial case reports articulated potential and actual catastrophic consequences of disordered eating on outcomes for those with T1DM. Whilst factors precipitating and mediating this link are as yet not fully understood, the link between T1DM and disturbed eating behaviours seems well established, with a focus developing beyond diagnosable eating disturbances to the clinical consequences of sub clinical eating disturbances.

To most effectively mitigate adverse health outcomes of disordered eating behaviours, and improve the metabolic control and therefore long term health outcomes of adolescents with T1DM, a greater understanding of these behaviours and attitudes, along with the precipitating factors is warranted. Such understanding would permit more effective screening and prevention strategies to minimise the use of disordered, unhealthy weight management behaviours as part of a young person's repertoire for managing weight.

The aims and objectives of this research were to investigate the mediating role of appearance-related schema in the pattern of eating attitudes and behaviours in adolescents with T1DM. If appearance-related schemas are found to be predictive of disordered eating behaviours in adolescents with T1DM, therapeutic interventions based on promoting a positive body image, a larger repertoire of positive self-schema, and a broader basis for self-definition may therefore be clinically useful in terms of treating this at risk population.

2.10 Research Questions and Hypotheses

2.10.1Research question 1.

Do adolescents living with T1DM display significantly more disordered eating behaviours than adolescents living without T1DM?

Hypothesis 1:

Adolescents living with T1DM will display significantly more disordered eating attitudes and behaviours than adolescents living without T1DM.

2.10.2Research question 2.

Do adolescents living with T1DM have greater investment in body image for self-definition than adolescents living without T1DM?

Hypotheses 2 and 3:

2. Adolescents living with T1DM will have significantly higher investment in body image for self-definition that adolescents living without T1DM.

3. Adolescents living with T1DM will have significantly higher Self-Evaluative Salience in relation to Body Image than adolescents living without T1DM.

2.10.3 Research question 3.

Does a greater investment in body image for self-definition predict engagement in disordered eating attitudes and behaviours?

Hypotheses 4 and 5:

4. Investment in body image for self-definition will be predictive of eating attitudes and behaviours for adolescents living with and without T1DM.

5. Investment in body image for self-definition will be predictive of diabetes-specific eating problems for adolescents living with T1DM.

3.0 Method

3.1 Design

The study utilised an independent between groups design, with two groups - comprising adolescents living with T1DM, and non-diabetic controls. The study explored one independent variable, diabetes status, and three dependent variables: eating attitudes, appearance-related schema, and diabetes-specific eating problems.

3.2Participants

The clinical sample was sought from two acute Trusts in the Midlands of England. Participants were recruited from out-patient diabetic clinics, offering regular appointments to individuals living with T1DM within a geographical area, serving children aged 11-18 years. A multi-centre study, with 640 patients registered in these trusts, was selected to enhance representativeness of sample and likelihood that an adequate sample size would be achieved. Participants without diabetes were accessed via two secondary schools in the Midlands who educate children from 11-18 years.

Both male and female adolescents were studied. Most research on diabetes and eating disorders has focused primarily on females because of the higher prevalence rates. As T1DM affects both males and females, and very little research has been conducted with males, it was deemed important and clinically relevant to study this phenomenon in males as well. Matching of participants between groups was attempted for age and sex.

3.2.1 A priori power calculation.

Previous research has reported sample sizes varying from 45 (Rukiye, 2005) to 662 (Colton et al., 2004). It was difficult to take an approximation of mean differences across the literature, as most authors had utilised different measures and methodologies. Pinar (2005)

using a similar measure to be adopted in this research, had utilised the EAT-40 for measuring the difference in prevalence rates of disordered eating attitudes between a diabetic and control sample, revealing an approximate difference of 12, with a standard deviation of 10 between their diabetic and control group on this measure. In order to show a similar difference of 12, with a standard deviation of 10, $\alpha = 0.05$, power 0.80, 12 participants would be needed in each group, thus requiring 24 participants in total. The difference found by Pinar (2005) appeared large in comparison to other research, so the current research was informed by a more conservative estimate. In order to detect a smaller mean difference of 5, with a standard deviation of 10, $\alpha = 0.05$, power = 0.80, 64 participants would be needed in each group, a total of 128 participants. Thus a total of 100 participants in this research, with 50 in the diabetic sample, and 50 in the control sample was deemed reasonable. With 50 participants in each group, s.d = 10, $\alpha = 0.05$, power = 0.80, a mean difference of 5.7 would be able to be detected between the two groups.

3.2.2 Exclusion/inclusion criteria.

Inclusion criteria were: 11-18 years age range. For adolescents living with T1DM, a diagnosis of T1DM should have exceeded one year to allow a process of adjustment to living with a chronic medical condition to have occurred. Exclusion criteria comprised: a diagnosis of Type 2 Diabetes an additional diagnosis of a physical or mental health condition; lack of fluency in the English language; or absence of parental consent.

3.3Measures

3.3.1 Measures to investigate the prevalence of disordered eating attitudes/weight management behaviours

Children's Eating Attitudes Test (ChEAT) (Maloney, McGuire, Daniels, & Specker, 1989)

The ChEAT was selected to investigate eating attitudes and behaviour of the adolescents since it has been validated for use with a population up to sixteen years of age. The ChEAT is a 26-item self-report measure developed as an adjusted version of the Eating Attitudes Test, originally developed by Garner & Garfinkel (1979) to determine disordered eating attitudes in children up to the age of 16. Participants are asked to rate the frequency of each attitude or behaviour on a six item Likert scale, with answers to each question ranging from 'Never' (1) to 'Always' (6). Validity testing of the ChEAT confirms that recoding of scores is required so that the three least symptomatic, (never/rarely/sometimes) are recoded as 0, with 'often' =1, 'usually' =2, and 'always' coded as 3 (Maloney et al., 1989). The ChEAT total score therefore ranges from 0 to 78, and has a cut-off score of >20 for disordered eating. The ChEAT was issued to both diabetic and control groups. The ChEAT has been shown to be a reliable measure with Cronbach's alphas of 0.76 for internal reliability, and 0.75-0.88 for test-retest reliability (Maloney el al., 1989).

The Diabetes Eating Problem Survey (DEPS) (Antisdel, Laffel & Anderson, 2001)

The DEPS was selected to assess aspects of diabetes regimen manipulation for the purpose of weight control and was issued only to those with diabetes. It is a 27 item measure, with participants scoring frequency of behaviours on a six point Likert scale ranging from

'Never' (0) to Always (5). Scores range from 0 to 135, with a cut-off of 40 for identifying problematic levels of diabetes regimen manipulation for the purposes of weight control. Reliability and validity has been established, with an internal consistency of α=0.95 (Antisdel et al., 2001). It has been validated for use in a group of young women older than 20 years, but has been used with an adolescent population (Neumark-Stainzer et al., 2002).

3.3.2 Measures to investigate appearance and weight related self-schema.

The Appearance Schemas Inventory (ASI-R) (Cash, Melynk, & Hrabosky, 2004).

The ASI-R was selected to assess investment in body image for self-definition. The ASI-R is a 20 item instrument, comprising two sub-scales: Self-Evaluative Salience and Motivational Salience. Self-Evaluative Salience reflects the extent to which individuals define or measure themselves and their self-worth by their physical appearance, which they deem influential in their social and emotional experiences. Motivational Salience refers to the extent to which a person attends to their appearance, and engages in appearance management behaviours. Participants rate items on a 5 point Likert scale, ranging from 'strongly disagree' (1) to 'strongly agree' (5). The composite ASI-R score is the mean of the 20 items ranging from 20 to 100. The Self-Evaluative Salience score is the mean of 12 items, ranging from 12 to 60, with the Motivational Salience score being the mean of eight items, ranging from 8 to 40. The composite ASI-R and its two factors have shown high internal consistency, (Table 1), and were significantly convergent with other measures of body image (Cash & Labarge, 1996). The measure has been validated on a population above 18 years of age, but has been used with an adolescent population (Karen & Josee, 2008).

Table 1: Internal consistencies of the ASI-R and its subscales

ASI-R Scale	Men	Women
Composite ASI-R	0.90	0.88
ASI-R Self-Evaluative Salience	0.84	0.82
ASI-R Motivational Salience	0.91	0.90

3.3.3 Other Measures/Information.

The constructs under investigation have also been shown to be present in individuals with depression and low self-esteem, and the following tools were therefore utilised.

The **Children's Depression Inventory (CDI) (Kovacs, 1992)**

The CDI is a brief self-report scale assessing cognitive, affective, and behavioural signs of depression in children and adolescents aged 6 to 17 years. It was selected to assess the influence of depression on the constructs under investigation. The scale contains 27 items, each of which consists of three statements, scoring 0 to 3. Scores therefore range from 0 to 81. The measure has shown internal consistency co-efficients from 0.71 to 0.89, with the test-retest co-efficients ranging from 0.74 to 0.83 (Kurtz, 1998).

The Rosenberg Self-Esteem Scale (RSES) (Rosenberg, 1965)

This was administered to control for any influence self-esteem may have on the presence of disordered eating attitudes and behaviour. It is a 10-item self-report measure of global self-esteem, relating to overall feelings of self-worth and self-acceptance. Participants respond to items on a three point Likert scale, from 'Strongly Disagree' (0) to 'Strongly Agree' (3). Scores therefore range from 0 to 30. The scale was originally developed for use

with an adolescent population, and is therefore validated for use with the current sample (Rosenberg, 1965).

Thus in total, there were five psychometric measures that each participant with diabetes was required to complete, with four completed by the control group, due to the omission of the DEPS. Completion took approximately 15-30 minutes, and varied between participants. Completion of measures was piloted by a group of five pupils accessed through the secondary schools described above, who did not participate in the research.

Additional demographic information was also obtained, including: age, sex, and ethnicity to determine influence of demographics on the dependent variables in question.

Full copies of the questionnaires are available in Appendix D.

3.4 Procedure

3.4.1 Participants living with diabetes.

The researcher attended regularly scheduled out-patient diabetic clinic appointments over a four month period. Potential participants were approached in the waiting area of the clinic, where the researcher talked briefly about the aims of the research, and what would be involved if they chose to take part. If interested, an information sheet describing the research was given to potential participants and their parents if children were younger than 16 years of age, due to the requirement for parental consent (Appendix E).

The researcher allowed sufficient time for the participants and parents to read through the information sheets, and ask questions. The researcher then obtained both parental and participant written consent in person, if they wished to participate in the research, with a consulting room available to allow the consenting process to be conducted privately. The researcher then offered the participants the option of completing the questionnaires while

waiting for their appointment, or returning them by post in a Stamped Addressed Envelope (SAE) at a later date if preferred. Similarly, participants also had a choice of completing the questionnaires in the waiting area, or using the consulting room space that was used solely for research purposes. Participants were provided with 'unique identification numbers' to allow them to withdraw from the research at a later point if required. Participants were also entered into a prize draw for £30 of high street vouchers to show appreciation for participating in the research. 'Unique identification numbers' were utilised for the prize draw, with the results of the draw being announced via poster at future clinics.

Details were given on the information sheets as to how data would be anonymised. Counter-signed copies of the consent forms were then returned by post to complete the process. All information packs also contained details of services and organisations able to provide advice and help should the participants be affected by the research, or if it raised any questions or concerns for them.

3.4.2 Participants living without diabetes.

Once agreement to participate in the research was gained at the school level by the head teachers, different procedures were adopted between the two sites due to differing preferences of the schools in question.

School A

Ninety five per cent of families of pupils attending this school are registered with the school for e-mail communication. Information sheets were converted for the research into pdf format and uploaded onto the school's website. An e-mail was then sent to all parents registered for e-mail communication, informing them of the presence and location of the invitation for their child to take part in the research, along with the information sheets for the

research (Appendix F). An opt-in slip was also included on the e-mail, and parents were advised to e-mail the researcher at her University e-mail address with an electronic copy of the opt-in slip, if their child wished to participate in the research. Once the opt-in slip was received by the researcher, the full research pack was then sent out to the participants. If the participants were less than 16 years of age, the consent form also needed to be completed and returned with the measures in a Stamped Addressed Envelope (SAE) which was provided.

As above, details were given on the information sheets regarding how data was anonymised. Counter-signed copies of the consent forms were then returned by post to complete the process. All information packs also contained details of services and organisations able to provide advice and help should the participants be affected by the research, or if it raised any questions or concerns for them. Participants were provided with 'unique identification numbers' to allow them to withdraw from the research at a later point if required. Participants were also entered into a prize draw for £30 of high street vouchers to show appreciation for participating in the research. 'Unique identification numbers' were utilised for the prize draw, with the results of the draw being announced at a whole school assembly by the Assistant Head Teacher.

School B

Classes were approached by the researcher as a group in an assembly. A cross-section of classes were approached, with the Deputy Head Teacher randomly selecting two classes from each year group, and three fifths of the sixth form, and inviting them to attend the assembly through invitations provided in class registers. A five minute presentation was then delivered to the potential participants, outlining the aims of the research and what would be involved if they chose to take part. An invitation letter, information sheets (Appendix F) plus opt-in slips and an addressed envelope were then issued to potential participants to take home.

A sealed box was provided in the reception of the school, for pupils to return their opt-in slips to by a nominated date. Once the opt-in slips were received by the researcher, the full research pack was then sent out to the participants. As above, the consent form needed to be completed and returned with the measures if the participants were under sixteen years of age. As above, details were also provided on the information sheets about how the data would be anonymised.

As above, all information packs contained details of services and organisations able to provide advice and help should the participants be affected by the research, or if it raised any questions or concerns for them. Participants were provided with 'unique identification numbers' to allow them to withdraw from the research at a later point if required. Participants were also entered into a prize draw for £30 of high street vouchers to show appreciation for participating in the research. 'Unique identification numbers' were utilised for the prize draw, with the results of the draw being announced at a whole school assembly by the Deputy Head Teacher.

3.5 Ethical Approval

Ethical approval was sought and gained from the Psychology Research Ethics Committee, University of Leicester and the Derbyshire Research Ethics Committee. The relevant letters and information can be found in Appendix G.

4.0 Results

4.1 Sample

Fifty two adolescents living with T1DM from a possible 92 (56.5% response rate), and 61 participants living without T1DM from a possible 1200 (5.1% response rate) took part in the research, thus a sample of 113 was gained. 162 participants initially agreed to take part in the research; therefore there was a 30.2% attrition rate at the point where the research packs were received.

4.2 Data Analysis

4.2.1 Description of participants.

Data were analysed using the Statistics for the Social Sciences (SPSS) Version 16.0. Table 2 displays the demographic details of the two groups. There were no significant between-group differences with regards to age, gender or ethnicity. Although non-significant, a greater difference existed between the groups in relation to ethnicity. A greater proportion of the diabetic group sample consisted of White British participants, whereas the non-diabetic group held a higher proportion of Asian Indian and Black African participants.

Table 2: Demographic variables describing the sample

Variable	**Diabetic group (N = 52)**	**Non-Diabetic Group (N=61)**	**$\chi 2$**	**Sig**
Mean age (SD)	15.02 (1.65)	14.64 (1.65)	9.82	0.20 (ns)
Gender (%)			0.39	0.53 (ns)
Male	20 (38.5)	27 (44.3)		
Female	32 (61.5)	34 (55.7)		
Ethnicity (%)			11.29	0.26 (ns)
White British	42 (88.8)	37 (60.7)		
White Irish	1 (1.9)	1 (1.6)		
Mixed. White and Black Caribbean	1 (1.9)	0 (0)		
Mixed. White and Black African	4 (7.7)	0 (0)		
Mixed. White and Asian	1 (1.9)	2 (3.3)		
Asian or Asian British. Indian	4 (7.7)	12 (9.7)		
Asian or Asian British. Pakistani	1 (1.9)	1 (1.6)		
Asian or Asian British.	0 (0)	1 (1.6)		
Bangladeshi	1 (1.9)	0 (0)		
Black or Black British Caribbean	1 (1.9)	2 (3.3)		
Black or Black British. African	2 (3.8)	5 (8.2)		
Other				

4.2.2 Psychological morbidity of the sample.

There were no significant differences between groups for psychological morbidity, as assessed by the CDI, t (111) = -1.270, *p*=.21. Raw scores above the 85th percentile are defined as above the clinical cut-off, equating to a score of 20 on the CDI (Kovacs, 1992). Mean scores on the CDI showed the sample to be reporting scores in the non-clinical range. Investigation of CDI scores case by case yielded the following results for frequencies of participants scoring above clinical-cut off on the CDI (Table 3).

Table 3: Psychological morbidity of the sample

Variable	**Diabetic group (N = 52)**	**Non-Diabetic Group (N=61)**
Mean	2.27	2.58
Standard deviation	1.30	1.30
Below clinical cut-off	48	56
Above clinical cut-off	4	6

4.2.3 Preliminary analyses.

A series of t-tests were conducted to asses gender differences on the measures used to investigate the hypotheses. Table 4 highlights that there were significant differences of mean scores between male and female participants on all measures with the exception of the ASI-SES.

Table 4: Gender differences on measures

	Males (N=47)	**Females (N=66)**	**Sig**
ChEAT	2.50	3.06	0.01 (s)
ASI-R	3.09	3.59	0.00 (s)
ASI-SES	1.79	1.86	0.16 (ns)
ASI-MS	3.50	3.84	0.01 (s)
CDI	1.81	2.88	0.00 (s)
RSES	4.85	4.27	0.00 (s)

Before the data were analysed in relation to the research questions and hypotheses, a preliminary analysis was undertaken to establish appropriate application of tests, and check their assumptions. Parametric tests have three core assumptions: the data should be normally distributed, variance of scores around the mean should be homogeneous, and the measurement of data should be interval or ratio (Pallant, 2007). If criteria are not fully met, parametric tests have been shown to remain robust (Field, 2000).

The data were checked for outliers through the inspection of boxplots. Extreme cases were identified and explored further through the use of 5% trimmed means. No cases were highlighted as significantly influencing the data set, therefore no cases were removed.

The Kolmogorov-Smirnov statistic was utilised to assess the normality of the data (given sample size greater than 50 (Field, 2000; Tabachnick & Fidell, 2007)). Significant results were found for the following variables: ChEAT, ASI-Self-Evaluative Salience, CDI, and the RSES, highlighting that the data for these variables were not normally distributed. Square root transformations were conducted on these variables, and the data were checked again for normality. Transformations resulted in non-significant results on the Kolmogorov-Smirnov test of normality for the ASI-Self-evaluative salience, the DEPS, and the CDI variables, suggesting that these variables were now normally distributed. This finding was corroborated from inspection of the histograms and normal Q-Q plots.

Transformation did not yield a non-significant result for the ChEAT and the RSES, suggesting that these variables remained abnormally distributed. Values for skewness and kurtosis were investigated for these variables, and found to be relatively small (<1.1) for the RSES. The skewness value for the ChEAT was reasonable large at 0.46, however, as each cell had a sample size greater than 20, robustness to non-normality should be ensured (Stevens, 2002).

4.2.4 Reliability of measures.

To assess the reliability of the measures used, Cronbach alphas were computed for all measures, including the two sub-scales of the ASI-R - Self-Evaluative Salience, and Motivational Salience (Table 5).

Table 5: Summary of reliability analyses

Measures	**Cronbach's α**
ChEAT	0.80
ASI-R	0.92
ASI- Self-Evaluative Salience	0.88
ASI- Motivational Salience	0.87
DEPS	0.58
CDI	0.87
RSES	0.89

All measures, with the exception of the DEPS, exceeded the acceptable minimum of 0.7 (Devellis, 2003). The DEPS did not meet an acceptable level of internal inconsistency, and was subject to further scrutiny of the item-total statistics. It was concluded after no items could be removed from the measure to improve the reliability of the scale that it would be removed from the study and not subject to further analysis.

4.3 Investigation of research questions and hypotheses

4.3.1 Research question 1.

Do adolescents living with T1DM display significantly more disordered eating behaviours than adolescents living without T1DM?

Hypothesis 1:

Adolescents living with T1DM will display significantly more disordered eating attitudes and behaviours than adolescents living without T1DM.

Scores above 20 on the ChEAT indicate disordered eating attitudes and behaviours. Table 6 displays the proportion of participants scoring above this pre-determined cut-off.

Table 6: Frequency of participants scoring above clinical cut-off for ChEAT

Variable	**Diabetic group (N = 52)**	**Non-Diabetic Group (N=61)**
Above clinical cut-off (%)	4 (7.7)	10 (16.4)
Below clinical cut-off (%)	48 (92.3)	51 (83.6)

Table 4 suggests that the two groups are largely comparable; however, there are a greater proportion of participants scoring above clinical cut-off in the non-diabetic group. In order to test the hypothesis further, descriptive statistics were obtained for the ChEAT measure (Table 7), and an Analysis of Covariance (ANCOVA) was utilised to allow between-group differences to be analysed, whilst statistically controlling for the effects of depression and self-esteem.

Table 7: Descriptive statistics for the ChEAT

Diabetic status (n)	**Mean**	**Standard Deviation**
Diabetic (52)	2.78	1.20
Non-Diabetic (61)	2.86	1.35

ANCOVA is a parametric test, and therefore the assumptions described in 3.3.2 require consideration. ANCOVA has additional assumptions which will now be described.

ANCOVA assumes reliability of covariates. The covariates that were utilised were depression and self-esteem, both of which have been shown to exceed the acceptable level of internal consistency of 0.7 at respective levels of 0.87 and 0.89 (DeVellis, 2003). In addition, no strong correlations should exist between covariates if covariates are to contribute independently to a reduction in error variance (Pallant, 2007). Depression and self-esteem were significantly negatively correlated, $r = -0.67$, $n = 113$, $p<0.01$ suggesting that as self-esteem increases, depression decreases. This is unsurprising given that it is accepted that high self-esteem is protective against depression (Crocker, Luhtanen, Cooper, & Bouvrette 2003; Roberts & Gotlib, 1997). The correlation between covariates therefore needs to be borne in mind when interpreting the outcome on the ANCOVA, as the covariates may have limited power to reduce error variance on the ChEAT scores.

ANCOVA also assumes that a linear relationship exists between the dependent variable and the covariates (Pallant, 2007). Inspection of scatter plots revealed a linear relationship between eating attitudes and depression, and eating attitudes and self-esteem (Appendix H). A further assumption is homogeneity of regression slopes, i.e. that the relationship between the covariate and the dependent variable for each of the groups is the same. A Univariate Analysis of Variance (ANOVA) was utilised to test for this assumption; a significant result for depression, F (1, 112) = 6.65, $p = 0.01$, and a non-significant result for self-esteem F (1, 112) = 3.94, $p = 0.05$ were obtained. The assumption has therefore been violated for the depression covariate, suggesting that homogeneity of regression slopes does not exist between groups for the relationship between the dependent variable, eating attitudes, and the covariate, depression. The ANCOVA was therefore only performed with self-esteem acting as covariate. Levene's Test of Equality of Variances was used to test the assumption of

equality of variances. A non-significant result was found, F (1, 111) = 0.01, p = 0.90, therefore the assumption was upheld.

The result of the ANCOVA was F (1, 112) = 0.12, p = 0.91, a non-significant result, providing no evidence for hypothesis 1, that a difference would exist between adolescents with and without TIDM on eating attitudes and behaviour; the null hypothesis was therefore retained. Analysing the influence of the covariate showed a significant relationship between the covariate (self-esteem) and the dependent variable (eating attitudes), F (1, 112) = 23.46, p = 0.00. Examination of Partial Eta Squared values revealed that self-esteem was explaining 17.6% of the variance in the dependent variable.

4.3.2 Research question 2.

Do adolescents living with T1DM have greater investment in body image for self-definition than adolescents living without T1DM?

Hypothesis 2:

Adolescents living with T1DM will have significantly higher investment in body image for self-definition than adolescents living without T1DM.

The ASI-R allows individuals to be categorised as appearance schematic, or aschematic, depending on whether they score above or below 2.5, the mid-point on the Likert scale (Labarge, Cash, & Brown, 1998). Table 8 gives means for the proportion of schematics vs. aschematics between groups, highlighting that a marginally higher proportion of the diabetic group were appearance schematic, compared with the non-diabetic group.

Table 8: Appearance schematicity for participants.

Variable	Diabetic group (N = 52)	Non-Diabetic Group (N=61)
Appearance schematic (%)	49 (94.2)	53 (86.9)
Appearance aschematic (%)	2 (3.8)	8 (13.1)

As above, descriptive statistics were obtained (Table 9) and an ANCOVA was utilised to test between-group differences on appearance-related schema, with self-esteem and depression acting as a covariates.

Table 9: Descriptive statistics for the ASI-R

Diabetic Status (n)	Mean	Standard Deviation
Diabetic group (51)	3.45	0.65
Non-diabetic group (61)	3.32	0.73

The assumption of a linear relationship between the dependent variable and the covariates was investigated. Inspection of scatter plots revealed a linear relationship between appearance-related schema and depression, and appearance-related schema and self-esteem (Appendix H), upholding the assumption. A univariate ANOVA was performed to test the assumption of homogeneity of regression slopes. A non-significant result was obtained for depression, F (1,111) = 0.25, p = 0.87, and self-esteem, F (1, 111) = 0.35, p = 0.55. The assumption was therefore upheld, and both covariates were retained for the ANCOVA. Levene's Test of Equality of Variances was used to test the assumption of equality of variances. A non-significant result was found, F (1, 110) = 1.41, p = 0.24, therefore the assumption was upheld.

The result of the ANCOVA was F (1, 111) = 2.18, p = 0.14, a non-significant result, providing no evidence for hypothesis 2, that a significant difference would exist between adolescents with and without T1DM; the null hypothesis was therefore retained. Analysing the influence of the covariates yielded a significant relationship between the covariate (self-esteem) and the dependent variable (appearance-related schema), F (1, 111) = 4.58, p = 0.04, with a non-significant relationship being found between depression and appearance-related schema F = (1,111) = 3.34, p = 0.07. Examination of Partial Eta Squared values revealed that self-esteem was explaining 4.1% of the variance in the dependent variable.

Hypothesis 3:

Adolescents living with T1DM will have significantly higher Self-Evaluative Salience in relation to Body Image than adolescents living without T1DM.

Descriptive statistics were obtained (Table 10) and an ANCOVA performed to test the between-group differences on Self-Evaluative Salience in relation to appearance-related schema, with depression and self-esteem acting as covariates.

Table 10: Descriptive statistics for Self-Evaluative Salience

Diabetic Status (n)	Mean	Standard Deviation
Diabetic group (51)	1.77	0.21
Non-diabetic group (61)	1.88	0.26

The assumption of a linear relationship between the dependent variable and the covariate was investigated. Inspection of scatter plots revealed a linear relationship between eating attitudes and Self-Evaluative Salience (Appendix H), upholding the assumption. A univariate ANOVA was performed to test the assumption of homogeneity of regression

slopes. A non-significant result was obtained for depression, F (1,111) = 0.09, p = 0.76, and self-esteem, F (1, 111) = 0.67, p = 0.42. The assumption was therefore upheld, and both covariates were retained for the ANCOVA. Levene's Test of Equality of Variances was also used to test the assumption of equality of variances. A non-significant result was found, F (1, 110) = 1.97, p = 0.16; therefore the assumption was upheld.

The result of the ANCOVA was F (1,111) = 4.47, p = 0.04, suggesting a significant difference at the p = 0.05 level. Inspection of the means reveals a higher value for Self-Evaluative Salience in the non-diabetic group; therefore the null hypothesis must be retained due to the one-tailed nature of the hypothesis. Analysing the influence of the covariates yielded non-significant results for both depression and self-esteem, suggesting no relationship between the covariates and Self-Evaluative Salience. Examination of Partial Eta Squared values revealed that diabetic status was explaining 4.0% of the variance in the dependent variable.

4.3.3 Research question 3.

Does a greater investment in body image for self-definition predict engagement in disordered eating attitudes and behaviours?

Hypotheses 4 and 5:

4. Investment in body image for self-definition will be predictive of eating attitudes and behaviours for adolescents living with and without T1DM.

5. Investment in body image for self-definition will be predictive of diabetes-specific eating problems for adolescents living with T1DM.

Standard multiple regression was utilised to determine the predictive value of Body Image for self-definition on disordered eating attitudes and behaviour. Multiple regression

requires several assumptions to be met before it is used, and these will now be discussed.

Multiple regression assumes no multicollinearity - the correlation between independent variables. The correlation matrix was examined, and no evidence of multicollinearity found. Multicollinearity was examined further though the use of Tolerance and VIF values. No evidence of multicollinearity was found as tolerance values of less than .10 and VIF values above 10 were not present (Pallant, 2007); the assumption was therefore upheld.

Multiple regression is also very sensitive to the presence of outliers. The Normal Probability Plot (P-P) of the regression standardised residual was examined and it was found that the points lay in a diagonal straight line (Appendix H). Tabachnick and Fiddel (2007) define outliers as standardised residuals of greater than 3.3 or less than -3.3, therefore, the scatterplot showed no evidence of outliers (Appendix H). As no evidence of outliers was found, further analysis using Mahalanobis distance was not performed, and the assumption was deemed to be upheld.

Finally, multiple regression assumes normality, linearity, homoscedasticity and independence of residuals. Regression assumes that residuals should be normally distributed around the predicted dependent variable scores. Residuals should have a straight-line relationship with predicted dependent variable scores, with the variance of the residuals around predicted dependent variable scores being the same for all predicted scores (homoscedasticity). Inspection of the scatterplot (Appendix H) found no evidence of the above, and the assumption was upheld.

As assumptions were upheld, a multiple regression analysis was performed, with 30.8% of the variance in eating attitudes and behaviour was explained by the model. The model was significantly predictive of variance in eating attitudes and behaviour, F (5,111) =

9.44, $p = 0.00$. Self-esteem, appearance-related schema and Self-Evaluative Salience were the strongest independent contributors to the model, however, only self-esteem was significantly predictive, $t = 2.38$, $p = 0.02$. Self-esteem was independently predicting 19.3% of variance in eating attitudes and behaviour, with appearance-related schema explaining 8.9% of the variance, and Self-Evaluative Salience independently explaining 12.1% of the variance. In relation to hypothesis 4, the null was retained as body image for self-definition was not found to be significantly predictive of eating attitudes and behaviour.

No between-group differences were hypothesised in terms of appearance-related schema predicting eating attitudes and behaviour, however, given some unexpected between-group differences for previous hypotheses, the regression analysis was run separately for the diabetic and non-diabetic group to ensure that between-group differences were not affecting the regression model. Both regression models were significantly predictive for both groups; diabetic group – F (5, 50) = 3.02, $p = 0.02$, explaining 25.1%, non-diabetic group – F (5, 60) = 9.32, $p = 0.00$, explaining 45.9% of the variance. None of the independent variables were significantly predictive of eating attitudes and behaviour for the diabetic group. Motivational salience was the most predictive variable, explaining 11.5% of the variance. For the non-diabetic group, self-esteem remained the only significant predictor of eating attitudes and behaviour, $t = -2.47$, $p = 0.02$, explaining 24.5% of the variance in the model. Although non-significant, appearance-related schema and Self-Evaluative Salience were the next two largest predictors of eating attitudes and behaviours, explaining 10.4% and 16.4% respectively.

Hypothesis 5 was not tested as the DEPS was removed from the analysis due to not obtaining satisfactory internal consistency (Table 4).

5.0 Discussion

The current study investigated the mediating role of appearance-related schema on the pattern of eating attitudes and behaviour in adolescents with TIDM. The hypotheses addressed three main research questions; whether adolescents living with T1DM displayed significantly more disordered eating behaviours than adolescents living without T1DM; whether adolescents living with T1DM had greater investment in body image for self-definition than adolescents living without T1DM; and finally whether greater investment in body image for self-definition predicted engagement in disordered eating attitudes and behaviours for both those living with and without T1DM. Each research question will now be discussed in turn.

5.1 Research Question 1 – Eating Attitudes and Behaviour

The first hypothesis, that adolescents living with T1DM would display significantly more disordered eating attitudes and behaviours than adolescents living without T1DM, was not supported by the research. Although a non-significant result was gained, participants in the non-diabetic group had higher levels of disordered eating attitudes and behaviours than those in the diabetic group. This finding contradicts the majority of research, in which results suggest that adolescents with T1DM are at greater risk of developing clinical and sub-clinical eating disorders than their non diabetic peers (Jones et al., 2000; Fairburn et al., 1991; Peveler et al., 1992; Affenito, et al., 1997; Colton et al., 2004; 2007; Peveler et al., 2005). However a more circumscribed body of research has yielded similar results to the current study, whereby no significant differences were found between diabetic adolescents and controls. Ackard and colleague's (2008) findings indicated that adolescents with T1DM were not at increased risk of unhealthy weight control behaviours or weight dissatisfaction, and were actually less likely to engage in unhealthy weight control behaviours and were more satisfied with their weight

than peers, a similar finding to this research. Meltzer et al. (2001) report a similar finding, with male adolescents with T1DM reporting fewer symptoms of bulimia and adolescent females reporting significantly less body dissatisfaction than non-diabetic peers, as did. Striegel-Moore, Nicholson and Tamborlane (1992) who found no significant differences between EDI scores for adolescents with and without T1DM. Through investigating diagnosable eating disorders, Fairburn and colleagues (1991) and Peveler and colleagues (1992) also both reported comparable rates of eating disorders between those with and without T1DM. As a possible explanation for their findings, Ackard and colleagues (2008) suggested that accessing participants with T1DM through endocrinology clinics vs. accessing a population-based sample of participants through schools may account for the difference, as the participants accessed through schools would be more likely to exhibit a less controlled range of healthy eating behaviours.

Although adolescents with T1DM did not display higher levels of disordered eating attitudes and behaviour than adolescents without T1DM, there was evidence of eating pathology found within the diabetic group. Both groups included participants who scored highly on measures of disordered eating attitudes and behaviour. Mean scores were however low for both groups (between 2 and 3), suggesting a relatively low level of eating pathology for both groups. As the sample comprised a minority with eating difficulties, the low mean scores will not have reflected the small proportion of the sample that have more severe eating difficulties.

In light of this, inspection of frequency of participants scoring above the clinical-cut off, unsurprisingly, reveals a different picture. The ChEAT provides a cut-off of scores above 20 which indicates clinically significant eating difficulties. In this sample, 7.7% of participants with T1DM scored above cut-off, and 16.4% scored above clinical cut-off in the non-diabetic group, approximately twice the level reported in the non-diabetic group.

Although the pre-determined cut-off given with the ChEAT is by no means diagnostic, it gives an indication of a level of eating difficulty more typically seen in an individual with or at risk of developing an eating disorder. Epidemiological evidence suggests that approximately 1-2% of the adolescent and young adult population suffer with an eating disorder (Carr & McNulty, 2007). The results of this study reveal much higher levels of eating difficulties, however, due to the non-diagnostic nature of the ChEAT, a higher prevalence of eating difficulties would be expected, as sub-clinical as well as clinical levels of eating difficulties are included. Sancho, Arija, Asorey and Canals (2007) found a prevalence of 13% in a study utilising the ChEAT with adolescent males and females, more comparable to results found in this study.

5.2 Research Question 2 – Investment in Body Image for Self-definition

The second hypothesis, that adolescents living with T1DM would have significantly higher investment in body image for self-definition than adolescents living without T1DM was not supported by the research. Although a non-significant result was obtained, inspection of means and frequency of participants categorised as schematic revealed those living with T1DM to be marginally more appearance-schematic than participants living without T1DM. This finding is similar to several other research findings in which results suggest that adolescents with T1DM report higher levels of body dissatisfaction and drive for thinness, (Jones et al., 2000; Colton et al., 2007; Goebel-Fabbri et al., 2002; Olmsted et al., 2008; Thompson & Smolak, 2001; Ackard et al., 2008; Neumark-Stainzer et al., 2002; Peveler et al., 2005).

The third hypothesis, that adolescents living with T1DM would have significantly higher Self-Evaluative Salience in relation to Body Image than adolescents living without T1DM was not supported the research. If anything, the non-diabetic group had marginally

higher mean scores for self-evaluative salience, which again is surprising. The results of the second and third hypotheses suggest that the slightly higher incidence of appearance schematicity in the diabetic group may be due to differences in motivational rather than self-evaluative salience. This was confirmed through the use of a t-test, which highlighted a significant difference in motivational salience between the two groups, with the diabetic group having higher mean scores than the non-diabetic group, $t = 2.08$, $p = 0.04$.

Motivational salience relates to attitudes and behaviours associated with an individual's efforts to improve or maintain certain aspects of physical attractiveness and may not be problematic if the goal is to care for appearance, whilst not assuming that appearance is instrumental to self-worth (Cash et al., 2004). The SES-MS split found in this research suggests that in the non-diabetic group individuals may be more likely to evaluate their self-worth based largely on appearance, whereas individuals in the diabetic group may be attending to their appearance whilst not using appearance to evaluate their self-worth.

The diabetic groups higher score for motivational salience rather than self-evaluative salience seems supported by the lower rates of disordered eating in the diabetic group, whilst the higher scores for self-evaluative salience in the non-diabetic group goes hand in hand with an increased incidence of disordered eating. Empirical evidence supports the SES-MS distinction that self-evaluative salience is associated with more psychological and body image disturbance than is motivational salience (Cash et al., 2004; Melnyk et al., 2004; Rudiger et al., 2007).

5.3 Research Question 3 – Prediction of Eating Attitudes and Behaviour

The regression model was significantly predictive of eating attitudes and behaviour for both groups, explaining 25.1% of the variance in the diabetic group, and 45.9% of the variance in the non-diabetic group. For the diabetic group there were no significant

independent predictors; motivational salience was the strongest predictor, explaining 11.5% of the variance. For the non-diabetic group self-esteem was the only significant predictor of eating attitudes and behaviour, explaining 24.5% of the variance, with appearance-related schema and self-evaluative salience being the strongest non-significant contributors to the model. This finding supports previous research suggesting that global self-esteem is predictive of eating disorder symptoms (Joiner, Schmidt, & Wonderlich, 1997), and that investment in body image for self-definition is associated with disturbed eating attitudes and behaviours (Cash et al., 2004; Melnyk et al., 2004; Rudiger et al., 2007).

The ASI-R and its sub-components SES and MS were not significantly predictive of eating attitudes and behaviour, therefore, the fourth hypothesis was not supported.

5.4 Possible Explanations for the Findings

5.4.1 Research question 1.

Three possible explanations appear to exist for the lack of difference between groups on eating attitudes. It may be that this is the level of disordered eating to be expected in an adolescent population and the presence of T1DM does not elevate the risk, an explanation that has some empirical support (Ackard et al., 2008; Meltzer et al., 2001; Striegel-Moore et al., 1992; Fairburn et al., 1991; Peveler et al., 1992). A second possibility is that T1DM may be protective against eating difficulties due to the need to control dietary intake for the preservation of long-term good health (Ackard et al., 2008). A final possibility is that the control group have higher levels of disordered eating than expected.

A possible underpinning explanation were the differences between groups regarding recruitment and methods used to conduct the research. The non-diabetic group were recruited through approaching large groups of potential participants (over 1000), with a small number

choosing to participate (5.1%). The diabetic group, however, were approached individually at diabetic clinic appointments, a method which yielded a much higher response rate (56.5%). Differences between responders and non-responders were therefore likely to exist between the two groups, which may account for the higher rate of disordered eating in the non-diabetic group.

In addition, all participants in the non-diabetic group completed their questionnaires at home, and were encouraged to complete them in private. Despite being given the choice and encouragement to complete questionnaires in private, the majority of diabetic participants completed their questionnaires in clinic waiting rooms in the presence of their parent(s) or guardian, which may have reduced the honesty of self-report in the diabetic group. The validity of self-report of health-care related behaviours has been investigated across a wide range of settings, and found to be highly variable and largely inaccurate (Bender, Boulet, Chaustre, & Rand, 2003), with children and young people often under-reporting undesirable behaviours if a parent is present (Aquilino, Wright, & Supple, 2000).

How anonymity is guaranteed for the participant appears crucial (Lavender & Anderson, 2009). Response formats that offer greater levels of anonymity than standard questionnaires, such as the unmatched count technique which allows for complete response anonymity, have produced higher rates of self-report of eating disordered attitudes and behaviour than self-reports in a traditional true/false questionnaire (Anderson, Simmons, Milnes, & Earleywine, 2007; Lavender & Anderson, 2008). This has particular relevance for the diabetic group in this research, who largely returned their completed questionnaires in person to the researcher.

5.4.2 Research question 2.

It was hypothesised that the diabetic group would have a higher rate of disordered eating, and that appearance-related schema would be mediating this link. The lack of a

significant difference in eating attitudes and behaviour is likely to account for no significant difference between-groups on appearance-related schema. As the first hypothesis was not supported, it seems reasonable that the second hypothesis would also not be supported.

Given the results obtained, that the non-diabetic group had marginally higher levels of disordered eating than the diabetic group, it is understandable that the non-diabetic group would also have slightly higher scores for self-evaluative but not motivational salience in terms of body image, and thereby why the third hypothesis was also not supported.

5.4.3. Research question 3.

In relation to the fourth hypothesis, appearance-related schemas were not found to be predictive of eating attitudes and behaviour. This may be because, despite the relatively high level of appearance schematicity in the sample, this schematicity was largely due to motivational rather than self-evaluative salience. As mentioned previously Cash et al. (2004) posits that motivational salience may not be problematic if the goal is to care for appearance, whilst not assuming that appearance is instrumental to self-worth. In order to confirm this suggestion, the regression analysis was run again with the addition of Motivational Salience to the model. The results revealed that Motivational Salience was one of the weakest predictors of disordered eating, independently explaining only 5.4% of model (Appendix I).

The adequacy of the regression may well have been influenced by the non-normal distrubuion of ChEAT scores. The ChEAT had a reasonably large negative skew, suggesting that the majority of participants in the sample were reporting little or no eating difficulties. The sample size of those experiencing eating difficulties was therefore relatively small, suggesting that appearance-related schema and self-evaluative salience may have been significantly predictive of eating attitudes if the sample had been normally distributed in terms of eating attitudes and behaviours, i.e. a clinical sample.

A final possible explanation may be that the diabetic group were exhibiting relatively few difficulties in relation to eating, as they had found other, diabetes-specific ways, to control their weight, namely, insulin manipulation. A diabetes-specific measure such as the DEPS would have tapped into these behaviours; unfortunately, this could not be included in the research due to the lack of acceptable reliability. A rudimentary analysis of the DEPS suggested that as many of 50% of diabetic participants were using some degree of insulin manipulation; however, this result needs to be interpreted with caution due to the lack of internal consistency of the measure. The lack of biomedical markers also meant that this finding could not be validated through the inspection of HBA_{1C} measurements.

Self-esteem was the only significant predictor of eating attitudes and behaviour in the non-diabetic group. No significant predictors were found for the diabetic group; however, motivational salience was the strongest non-significant predictor. It is possible that social desirability effects could account for this difference (Hogan & Ones 1997; Paulhus, 2002). As mentioned previously, the diabetic participants largely completed the measures in the presence of a parent or guardian. Attention to appearance is something which is valued in the western world, therefore adolescents may have felt more comfortable reporting attitudes and behaviours associated with caring for appearance (motivational salience) than attitudes reflective of low self-worth (self-esteem).

5.4.4. Gender and cultural differences.

Table 4 highlights that significant gender differences existed on all measures with the exception of the ASI-SES. Male participants generally exhibited; lower levels of unhealthy eating attitudes, lower appearance-schematicity, lower motivation to improve/maintain appearance, lower rates of depression, and higher rates of self-esteem. There were no significant gender differences on ASI-SES, suggested that that there were no gender differences on participant's investment in body image for self definition. The generally lower

level of difficulties expressed by male participants as investigated by these measures may have impacted on the results obtained, particularly on the regression model. Prediction of unhealthy eating attitudes is difficult to achieve when the sample is comprised of a majority of participants who are expressing healthy eating attitudes and behaviour. It may be that the regression model would have highlighted further significant predictors if only female participants had been investigated. There were no significant differences between the number of male and female participants in each group, therefore it is not expected that the inclusion of male participants will have affected the two groups differentially.

There were no significant differences between the two groups in terms of ethnicity, although there were a slightly higher proportion of White British participants in the diabetic group, whereas the non-diabetic group held a marginally higher proportion of Asian Indian and Black African participants. The cultural sensitivity of the measures warrants consideration, for example, two items on the ChEAT, 'I give too much time and thought to food' and 'I enjoy trying rich foods', may be influenced by cultural factors, where value is placed on sharing rich food with family and friends, often forming the focus of family life. These cultural differences need to borne in mind when interpreting the results.

5.5 Limitations

A limitation of the current study is the lack of a normal distribution on the measure of eating attitudes and behaviour, making predicting eating attitudes and behaviours problematic. The lack of acceptable reliability gained on the DEPS resulted in this measure being eliminated from the study, thus, diabetes-specific eating-related problems could not be assessed, a significant limitation given the health consequences of behaviours such as insulin manipulation.

It was hoped that biomedical markers would be obtained, i.e. BMI and HBA_{1C} measures. It was, however, difficult to gain ethical approval for such data collection due to difficulties in preserving participant's anonymity. It therefore was not possible to assess eating difficulties in relation to BMI (a known risk factor) and to understand more about the health consequences of such behaviour. The inability to utilise the DEPS coupled with a lack of biomedical markers meant that the health consequences of diabetes-specific eating problems and non-adherence to treatment also could not be addressed, posing an additional limitation.

As noted the use of a self-report questionnaire raises difficulties with honest disclosure. The relatively low response rates for the diabetic group and the very low response rates for the non-diabetic group suggests that there may have been differences between responders and non-responders in this study; however, this remains speculative as data on non-responders was not collected. It may be that those participants experiencing greater difficulties with eating, body image, or generally experiencing more distress, were more or less likely to participate in the study.

Although the measures used in this study were shown to have good reliability, self-report questionnaires offer a lower level of sensitivity to detect eating difficulties than, for example, diagnostic interviews. The rates of eating difficulties detected may therefore have been artificially lower due to the measures employed to investigate the constructs in question.

5.6 Clinical Implications

Despite the hypotheses in this study not being supported, evidence of disordered eating was found in the diabetic group. Although data from the DEPS was not fully utilised, a rudimentary analysis suggested as many as 50% of diabetic participants were not adhering to their treatment regime. The detrimental health consequences of clinical and sub-clinical eating

difficulties and non-adherence with treatment, such as insulin manipulation are well known (Diabetes Control and Complications Trial, 2000; Kahn, 1994; Rydall et al., 1997; Bryden et al., 1999; Goebel-Fabbri et al., 2008; Khan & Montgomery, 1996; Olmsted et al, 2008).

Although appearance-related schemas were not found to be significantly predictive of disordered eating, appearance-related schemas, particularly their sub-component of Motivational Salience were found to explain some of the variance in the model for the diabetic group. The role of cognitive facets of body image should therefore not be dismissed until this finding can be replicated with a normally distributed sample.

This research has discovered that the ASI-R is a reliable measure with an adolescent population. If the role of appearance-related schema could be empirically supported the ASI-R may also act as a valuable screening tool for disturbances in body image, which may aid detection of eating difficulties and potentially non-compliance with treatment.

5.7 Future Research

The methodological difficulties with the sample, particularly the different response rates between the two groups, and the lack of normal distribution of scores on the ChEAT suggest that investment in body image for self-definition cannot be dismissed as a mediating role in the presence of disordered eating in adolescents with T1DM. A replication of the study with a clinical sample exhibiting a normal distribution of scores on the ChEAT would be valuable. A further possibility would be to administer the ASI-R to only those participants who score above clinical cut-off on a measure such as the ChEAT, thus allowing a more comprehensive assessment of the influence of appearance-related schema in the development and maintenance of disordered eating.

Motivational Salience has previously been suggested by Cash et al. (2004) to not necessarily be associated with eating and body image disturbances. Although a non-significant result, this research found that Self-Evaluative salience was more predictive of eating disturbances in the non-diabetic group, whereas Motivational Salience was one of the strongest predictors of disordered eating attitudes for the diabetic group. Investigating the MS-SES split further in the diabetic population may provide some clinically valuable insights which could be used to direct clinical screening and intervention.

Although it cannot be concluded, it is likely that some diabetic participants were under-reporting certain attitudes and behaviours due to where they were being asked these questions, and who they were with. This needs to be borne in mind when conducting future research in terms of how, when and where these questions are broached, especially in paediatric diabetic clinics where young people usually attend with a parent or guardian. It may be more beneficial to set aside a dedicated amount of time to conduct the research either before or after clinic appointments so that adolescents feel more comfortable leaving the waiting room and their parent(s) or guardian, without the fear that they will miss their diabetic appointment.

5.8 Conclusions

None of the hypotheses in relation to higher rates of disordered eating, appearance-related schema, and the predictive ability of appearance-related schema for disordered eating attitudes and behaviours were supported by this research. A non-significant higher proportion of disordered eating attitudes and behaviours and low self-esteem were found in the non-diabetic group, which may be a genuine between-group difference, or may reflect differences between-groups created by methodology and potential under-reporting in the diabetic group. The diabetic group showed slightly higher levels of motivational salience in relation to

appearance-related schema, whereas, the non-diabetic group expressed higher proportions of self-evaluative salience. Motivational salience was one of the strongest predictors of disordered eating attitudes and behaviours in the non-diabetic group, whereas, self-esteem was significantly predictive of disordered eating attitudes and behaviours in the non-diabetic group. The MS-SES split warrants further investigation in the diabetic population to confirm or disprove the preliminary results of this research.

The impact of appearance-related schema requires further investigation with individuals exhibiting disordered eating attitudes and behaviour. If empirical support was gained for the role of appearance-related schema in the development and maintenance of disordered eating attitudes and behaviour, this research has shown the ASI-R is a reliable measure when used with an adolescent population, and may therefore be a clinically useful screening tool.

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Critical Appraisal

1.0 Origins of Literature Review and Research Questions

The current study, which investigated appearance-related schema in adolescents with Type 1 Diabetes (T1DM), arose out of a long-standing interest in health psychology. My pre-training experiences of working in a chronic pain service had taught me that, whilst some physical health specialties were well established in terms of psychology input, others were somewhat lacking. I felt passionate about adding to the knowledge base in health psychology and as a consequence, to hopefully raise the profile of psychology in medical settings, as well as the quality (and quantity) of psychological care in physical health specialties.

From my preliminary reading into psychological aspects of diabetes care, difficulties with eating and treatment adherence appeared significant, especially in terms of the short and long-term health consequences of these behaviours, and the difficult task that clinicians were faced with in terms of screening and intervention. In exploring what could usefully be investigated in the Type 1 Diabetic population, I felt that, although it would probably be more of a challenge to gain ethical approval, conducting research with adolescents would be more fruitful, as early intervention appeared crucial in reducing the long-term detrimental health consequences of these behaviours.

My reading of the diabetes research also made me aware of something which has been given the label 'diabulimia', the deliberate misuse or omission of insulin to control weight. I was struck and alarmed by the drastic measures than individuals with T1DM were willing to take to manage their weight, something I was completely unaware of when I began my reading. I also felt strongly that there needed to be a greater understanding of this behaviour, particularly as the health consequences of this weight loss method seemed so stark. I was aware than 'diabulimia' had rarely been given the attention it deserved in the literature, often being investigated in the context of eating disorders, or other eating difficulties, rather than

being seen as a health phenomenon in its own right. Therefore, I decided to conduct a literature review of the impact of weight-related concerns on diabetes-specific weight management practices, along with the implications for health outcomes. This was to draw together what was already known about the use of insulin manipulation, but also to highlight the issues that were standing out to me, and to direct possible areas for future research.

From exploring research within the eating disorders population, I was aware of evidence supporting the role of cognitive aspects of the self-concept in the aetiology of eating disorders, particularly the role of schema (Stein, 1996; Stein & Corte, 2007). Initial reading of the diabetes care literature also made me aware that there was a lack of an operational definition of the term 'body dissatisfaction', which is so often referred to in the research as an aetiological factor of eating difficulties in the T1DM population (Jones et al., 2000; Ackard et al., 2008; Neumark-Stainzer et al., 2002; Peveler et al., 2005).

I wanted to explore this idea of body dissatisfaction further, particularly in terms of which constructs were important in influencing the development and maintenance of body dissatisfaction. Through exploring body image research further, I was also aware of a body of research investigating body image disturbances in a variety of chronic medical conditions such as: dermatology, dental medicine, obstetrics and gynaecology, urological disorders, endocrinology, oncology, and HIV(Cash & Pruzinsky, 2002), with a dearth of research investigating body image disturbance in T1DM. Whilst attitudinal aspects of body image had been considered in the literature, namely body dissatisfaction, there appeared to be no research on the role of cognitive aspects of body image. I therefore decided to target my research towards investigating the role of appearance-related schema, a cognitive aspect of body image, in the pattern of eating attitudes and behaviour, including diabetes-specific eating and treatment adherence difficulties in adolescents with T1DM.

2.0 Development of Research

The initial stages of research development felt like one of the most anxiety provoking parts of the research process. I often felt like I was 'stabbing in the dark', wading through vast amounts of research and methodological opportunities. The nature of the research question lent itself to a quantitative methodology, which I was pleased about, as I feel more at home with numbers than transcripts. Having said that, I did not have vast experiences of quantitative methodologies, particularly at doctoral level, and the thought of designing a sound methodology and applying correct statistical analyses was a source of anxiety for me.

Finding appropriate measures proved a challenging process. The Appearance Schemas Inventory-Revised (ASI-R) seemed like the perfect measure, as it measured the cognitive aspect of body image that I was looking for. Unfortunately, it had not been validated for use with an adolescent population, although I was aware that it had been utilised with participants in a similar age range to mine. The Diabetes Eating Problem Survey (DEPS), the only measure developed to investigate diabetes specific eating difficulties had similar difficulties. Due to the lack of suitable alternatives, I took a measured risk with these two measures, and while the ASI-R was found to be a reliable measure with this population, the DEPS unfortunately was not, resulting in it not being included in the research.

From reading other research in this area, I decided that adopting a multi-site methodology with a control group would be the most appropriate way of maximising the chance of obtaining a satisfactory sample. This, however, proved a difficult task as many of the trusts I approached had undergone, or were currently undergoing research trials. Consequently, they thought my research would push the boundaries of an acceptable research burden for their patients. I was able to get a local trust interested in the research, and having

the opportunity to work collaboratively with the diabetes teams was an excellent resource to me.

Gaining access to non-NHS sites for the control group was a more problematic task. I felt more at ease promoting my research to diabetes teams who were understandably interested in the area. Doing this in secondary schools, where there was no direct investment in diabetes care, I found more uncomfortable. I managed to gain access to two local schools. However, on reflection, it may have been more helpful to have a variety of schools in different locations taking part in the research. The schools that I utilised were independent schools, and therefore were not likely to be representative of the general population.

Despite these difficulties, working with the schools was a pleasure. The staff and students were very amenable to my presence, and willing to listen and take part in the research. Unsurprisingly, given the lack of direct relevance for them, a low response rate was gained, which left me wondering about the reasons behind the students' reasons to take part in the research or not.

3.0 Ethical Approval

On reflection, gaining ethical approval was the most difficult tasks of the research process. Although filled with panic on the day of my ethics panel, the process went as smoothly as it could. It did, however, take two months to complete amendments and have these approved. Luckily, the Psychology Ethics Committee who were processing the non-NHS aspect of my research provided me with very prompt approval, which allowed me to begin my control group data collection in earnest when the school year began.

Although I submitted my Research and Development (R&D) application at the same time as my IRAS application, due to what felt like extremely high, and perhaps unnecessary,

levels of rigor, I unfortunately did not receive my R&D approval until the middle of December' 09. As a result, I had experienced a huge set back to my data collection, as it was my plan to have completed data collection by the end of January' 10. Due to Christmas, and clinics not being scheduled, this resulted in me not being able to commence data collecting for my diabetic group until the middle of January' 10. At this point, it felt like the end was definitely not in sight, and this was a particularly difficult time for me, as my colleagues were close to finishing their data collection, whilst I felt that I was just beginning. On reflection, I am amazed that it all came together in the time that it did, which just shows what determination, support and having a supervisor who relentlessly willed me on can do!

4.0 Conducting the Research

Carrying out the data collection challenged me in many ways that I was not expecting. Beginning data collection made me acutely aware of the difference between my clinical and research roles. Spending the majority of my time in a clinical role, providing a psychological service to service-users who have opted-in to receive such a service, felt somewhat different to encouraging participation and interest in research. Although the merits of conducting research were at the front of my mind, I was also aware of this being difficult for everyone to appreciate, when research doesn't generate any immediate or even short-term benefits. I often felt that I was getting in the way of the immediate task of conducting an out-patient appointment with my long-term goal of improving psychological care to individuals with T1DM.

It became obvious after a few clinic attendances that the majority of patients have reasonably long waits of over half an hour for their out-patient appointments. Many of those who volunteered to take part in the research, understandably, wanted to complete the questionnaires while they waited. This was not the procedure approved by ethics, and

therefore, required a substantial ethics amendment to get this procedure approved. Once approved, this improved the response rate; however, these improvements were likely to have come at the price of a reduced honesty of reporting.

Unfortunately, due to clinic cancellations and not gaining the response rate that I was expecting, I became aware towards the end of January/early February that it was looking extremely unlikely that I would gain a satisfactory sample from the sites I was using. The diabetes team were most helpful in enabling me to investigate additional local contacts, and I managed to gain the interest of an additional trust. With desperate pleas to the R&D department for this trust I was able to gain approval promptly, and in just enough time for me to attend these extra clinics and gain an adequate sample. This felt very much 'touch and go' and I was pleased that I was able to gain the sample I hoped for even with these setbacks.

5.0 Writing Up

I found the write up of the literature review a challenging task at times. Insulin manipulation had rarely been investigated as a health phenomenon in its own right. Therefore, the task of disentangling it from other health and eating disorders behaviours, and synthesising the results, was a challenge at times. Despite this, I feel the literature review has a lot to say about how insulin manipulation has been investigated up to now, and how research should be focused to allow us to understand this behaviour more comprehensively in the future.

I have spent the last couple of months mainly sitting in front of the computer, and I think it is easy when submerged in the write-up to forget about all the work than came before, and, therefore, on reflection, I think that write-up of the research paper was the easier task. It was under my control, and all I needed to do was sit down and do it, although it did still have its challenges.

6.0 Critique of the Research

Having been through the whole research process, and knowing the outcome of the research, I think one of the major criticisms with the research was the sample. Due to difficulties with ethical approval, response rates, and time constraints, no matching was achieved between-groups for age and sex. It is also likely that the groups differed on socio-economic status, although this data was not collected. A lack of data on non-responders was a further limitation, and it is likely that differences existed between responders and non-responders, which may have influenced decision making around participation.

Conducting research with adolescents was deemed most appropriate due to the clinical relevance of disordered eating and treatment adherence in this developmental period. However, there were likely to be vast developmental and maturational changes between participants comprising the sample, which may have influenced the results. No developmental markers were taken, therefore, limiting the study's ability to interpret the effect of development on the results obtained.

A quantitative approach was the most appropriate methodology for investigating the research questions; however, I became aware that one of the downfalls of such an approach is the lack of depth of information gained. The research yielded vastly non-significant results, and whilst these could be discussed, it left me with many possible hypotheses about why this might have been. I realised that a qualitative methodology would have enabled me to explore some of these hypotheses further, and may be something to consider for future research.

Looking back on the research now, I think research in this area should continue to explore aetiological factors for disordered eating and treatment non-adherence through the use of measures such as the ASI-R, with the addition of learning from individuals experiences of struggling with these difficulties. I feel this would add to the current knowledge base in a

valuable way, and allow us to design more effective screening methods and interventions to reduce the impact these behaviours have on the health of these individuals.

7.0 Reflecting on the whole

Having started, endured and completed this process, and having the opportunity to reflect on it now, has allowed me to recognise what a valuable experience it has been. I have had the pleasure of meeting many passionate patients, siblings, parents and clinicians, and have been humbled by how well many young people manage living with a chronic medical condition on a day-to-day basis. On a personal note, I feel I have developed my ability of managing a clinical and research case load, something I hopefully can take with me in my future career.

8.0 References

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Appendix A: Results of database search

Database	Keyword searches	Total found	Exclusion criteria	Total articles excluded	Total articles included
Medline	Type 1 Diabetes Eating disorders	120	Review articles/case reports/comments/chapters Irrelevant content Not written in English language Qualitative research No inclusion of participants in the adolescent age range No analysis of prevalence of insulin omission as a weight management strategy Methodologically confounded Papers to be used contextually	37 23 11 3 8 14 2 11	
			Total number of articles	**109**	**11**
PsycINFO	Type 1 Diabetes Eating disorders	23	Dissertation Abstracts Review articles/case reports/comments/chapters Irrelevant content Not written in English language Qualitative research No inclusion of participants without an eating disorder Duplicates from previous search	4 5 6 2 4 1 1	
			Total number of articles	**23**	**0**

Database	Keyword searches	Total found	Exclusion criteria	Total articles excluded	Total articles included
CINAHL	Type 1 Diabetes Eating disorders	28	Review articles/case reports/comments/chapters Irrelevant content Qualitative research No inclusion of participants in the adolescent age range No analysis of prevalence of insulin omission as a weight management strategy Methodologically confounded Duplicates from previous searches	11 4 2 3 1 2 5	
			Total number of articles	**28**	**0**
Medline	Type 1 Diabetes Disordered eating	29	Review articles/case reports/comments/chapters Irrelevant content Not written in English language Qualitative research No inclusion of participants in the adolescent age range Duplicates from previous searches	7 9 1 2 1 9	
			Total number of articles	**29**	**0**

Database	Keyword searches	Total found	Exclusion criteria	Total articles excluded	Total articles included
PsycINFO	Type 1 Diabetes Disordered eating	15	Dissertation Abstracts Review articles/case reports/comments/chapters Irrelevant content Qualitative research Duplicates from previous searches	2 2 7 2 1	
			Total number of articles	**14**	**1**
CINAHL	Type 1 Diabetes Disordered eating	15	Review articles/case reports/comments/chapters Irrelevant content Qualitative research No inclusion of participants in the adolescent age range No analysis of prevalence of insulin omission as a weight management strategy	2 7 2 2 2	
			Total number of articles	**15**	**0**
Medline	Type 1 Diabetes Weight control practices	3	Irrelevant content Duplicates from previous searches	1 2	
			Total number of articles	**3**	**0**

Database	Keyword searches	Total found	Exclusion criteria	Total articles excluded	Total articles included
PsycINFO	Type 1 Diabetes Weight control practices	3	Review articles/case reports/comments/chapters Irrelevant content Duplicates from previous searches	1 1 1	
			Total number of articles	**3**	**0**
CINAHL	Type 1 Diabetes Weight control practices	15	Irrelevant content Not written in English language Qualitative research No inclusion of participants with Type 1 diabetes Duplicates from previous searches	7 1 1 3 3	
			Total number of articles	**15**	**0**
Medline	Type 1 Diabetes Weight management	9	Irrelevant content Not written in English language No inclusion of participants with Type 1 diabetes No analysis of prevalence of insulin omission as a weight management strategy Duplicates from previous searches	1 5 1 1 1	
			Total number of articles	**9**	**0**

Database	Keyword searches	Total found	Exclusion criteria	Total articles excluded	Total articles included
PsycINFO	Type 1 Diabetes Weight management	2	Qualitative research	1	
			Total number of articles	**1**	**1**
CINAHL	Type 1 Diabetes Weight management	125	Review articles/case reports/comments/chapters Irrelevant content Qualitative research No inclusion of participants with Type 1 diabetes No inclusion of participants in the adolescent age range No analysis of prevalence of insulin omission as a weight management strategy Duplicates from previous searches	4 54 1 61 1 2 2	
			Total number of articles	**125**	**0**
Medline	Type 1 Diabetes Weight related concerns	3	Irrelevant content Duplicates from previous searches	1 1	
			Total number of articles	**2**	**1**

Database	Keyword searches	Total found	Exclusion criteria	Total articles excluded	Total articles included
PsycINFO	Type 1 Diabetes Weight related concerns	3	Review articles/case reports/comments/chapters Qualitative research Duplicates from previous searches	1 1 1	
			Total number of articles	**3**	**0**
CINAHL	Type 1 Diabetes Weight related concerns	7	reports/comments/chapters Not written in English language No inclusion of participants without an eating disorder Papers to be used contextually	2 2 1 2	
			Total number of articles	**7**	**0**
Medline	Type 1 Diabetes Weight and shape concerns	3	Review articles/case reports/comments/chapters Irrelevant content Duplicates from previous searches	1 1 1	
			Total number of articles	**3**	**0**
PsycINFO	Type 1 Diabetes Weight and shape concerns	2	Review articles/case reports/comments/chapters Irrelevant content	1 1	
			Total number of articles	**2**	**0**

Database	Keyword searches	Total found	Exclusion criteria	Total articles excluded	Total articles included
CINAHL	Type 1 Diabetes Weight and shape concerns	2	Irrelevant content No analysis of prevalence of insulin omission as a weight management strategy	1 1	
			Total number of articles	**2**	**0**
Medline	Type 1 Diabetes Body Image	46	Review articles/case reports/comments/chapters Irrelevant content Not written in English language Qualitative research No analysis of prevalence of insulin omission as a weight management strategy Papers to be used contextually Duplicates from previous searches	4 23 8 1 2 1 7	
			Total number of articles	**46**	**0**
PsycINFO	Type 1 Diabetes Body Image	3	Irrelevant content Duplicates from previous searches	2 1	
			Total number of articles	**3**	**0**
CINAHL	Type 1 Diabetes Body Image	0	**Total number of articles**	**0**	**0**

Database	Keyword searches	Total found	Exclusion criteria	Total articles excluded	Total articles included
Medline	Type 1 Diabetes Body dissatisfaction	5	Dissertation Abstracts Irrelevant content Not written in English language Duplicates from previous searches	1 2 1 1	
			Total number of articles	**5**	**0**
PsycINFO	Type 1 Diabetes Body dissatisfaction	5	Review articles/case reports/comments/chapters Dissertation Abstracts Irrelevant content Not written in English language	1 2 1 1	
			Total number of articles	**5**	**0**
CINAHL	Type 1 Diabetes Body dissatisfaction	0	**Total number of articles**	**0**	**0**

Database	Keyword searches	Total found	Exclusion criteria	Total articles excluded	Total articles included
Medline	Type 1 Diabetes Insulin Omission	25	Review articles/case reports/comments/chapters Irrelevant content Not written in English language No inclusion of participants without an eating disorder No inclusion of participants in the adolescent age range Papers to be used contextually Duplicates from previous searches	9 2 1 2 2 1 8	
			Total number of articles	**25**	**0**
PsycINFO	Type 1 Diabetes Insulin Omission	6	Dissertation Abstracts Irrelevant content Not written in English language Duplicates from previous searches	2 2 1 1	
			Total number of articles	**6**	**0**
CINAHL	Type 1 Diabetes Insulin Omission	0	**Total number of articles**	**0**	**0**

Database	Keyword searches	Total found	Exclusion criteria	Total articles excluded	Total articles included
Medline	Type 1 Diabetes Insulin Misuse	10	Review articles/case reports/comments/chapters Irrelevant content Duplicates from previous searches	3 1 6	
			Total number of articles	**10**	**0**
PsycINFO	Type 1 Diabetes Insulin Misuse	2	Review articles/case reports/comments/chapters No inclusion of participants in the adolescent age range	1 1	
			Total number of articles	**2**	**0**
CINAHL	Type 1 Diabetes Insulin Misuse	0	**Total number of articles**	**0**	**0**
Total number of articles found		**504**	**Total number of articles selected**	**14**	

Appendix B: Data extraction form

Article ID Number:	
Title:	
Author:	
Journal	
Publication date:	

Details of study

Aims of study:

What is being investigated?

Insulin omission _____

Health outcomes of insulin omission _____

Both _____

Design/Method:

Method of defining Disordered eating behaviours:

Sub-categorised using psychiatric diagnoses _____

Alternative method of categorising DEB

_____

Sampling/Participants, including sample size and age of participants:
Measures used: Measures adjusted for use with diabetic participants _____
Data Analysis:
Reliability/Validity:
Findings: Prevalence of insulin omission _____ Prevalence of insulin misuse _____ Frequency/severity of insulin omission/misuse _____ Reason for omitting explored _____ _____ Separate prevalence rates given for those with and without eating disorders? _____ _____ BMI measurements _____

Other interacting factors controlled for?
_____
_____

Health outcomes (if applicable):

Metabolic control
_____
_____
_

Other health measures
_____

_____
__

Conclusions:

Notes:

Appendix C: Results of data extraction

ID	First Author	Year	Aims	What is being investigated?	Design and method
1	Ackard, D.M.	2008	Compare prevalence of disordered eating and body dissatisfaction between adolescents with T1DM and controls.	Weight/shape concerns in DEB. Insulin manipulation	Cross-sectional. Independent groups
2	Colton, P.A.	2007	Determine natural history and psychosocial predictors of DEB in girls with T1DM over a 1 year period.	Insulin manipulation	Longitudinal Repeated measures
3	Peveler, R.C.	2005	Describe clinical outcomes of adolescent and young adult female subjects with T1DM in relation to DEB over 8-12 years.	Insulin manipulation Health outcomes	Longitudinal
4	Colton, P.	2004	Compare prevalence of eating disturbances in pre-teen and early teenage girls with T1DM to non-diabetic peers.	Insulin manipulation	Cross-sectional Independent groups
5	Neumark-Stainzer, D.	2002	Examine prevalence of DEBs and associations with sociodemographics, BMI, weight perceptions, family functioning and metabolic control among adolescents with T1DM.	Insulin manipulation	Cross-sectional. No control group
6	Jones, J.M.	2000	Determine prevalence of eating disorders in adolescent females with T1DM compared with non-diabetic peers.	Insulin manipulation	Multi-centre, Cross-sectional Independent groups
7	Khan, Y.	1996	Investigate changes in relationships between diabetes, eating attitudes, externality and insulin omission.	Insulin manipulation as primary focus	Cross-sectional Independent groups Age/sex matched controls
8	Pollock, M.	1995	Determine prevalence of DSM-III eating disorders and the symptoms of maladaptive dietary/insulin management, with psychiatric/ biomedical correlates among youths with T1DM.	Insulin manipulation as primary focus	Longitudinal

ID	First Author	Year	Aims	What is being investigated?	Design and method
9	Peveler, R.C.	1992.	Determine prevalence of eating disorders and DEBs in adolescents with T1DM and a matched sample of controls.	Insulin manipulation	Cross-sectional, case controlled study. Controls matched for age/sex
10	Fairburn, C.G.	1991	Determine prevalence of eating disorders and DEBs in young adults with T1DM and a matched sample of non-diabetic female controls.	Insulin manipulation	Cross-sectional, independent groups design. Age/parental social class matched controls
11	Rodin, G.	1991	Assess frequency and implications of insulin misuse.	Insulin manipulation as primary focus	Cross-sectional
12	Howe, C.J.	2008	Determine prevalence of weight-control behaviours and the associations with gender, age, BMI, HBA $_{1C,}$ weight satisfaction, and weight perception.	Insulin manipulation as primary focus Health outcomes	Cross-sectional
13	Kichler, J.	2008	Examine maladaptive eating attitudes and behaviours in adolescent females with T1DM.	Insulin manipulation as primary focus	Cross-sectional
14	Lawrence, J.M.	2008	Describe weight loss practices and weight related issues in youths with diabetes, according to sex and diabetes type.	Insulin manipulation as primary focus	Multi centre cross-sectional

ID	Method of defining DEB	Measures	Measures adjusted for use with diabetic participants
1	Classified as extreme/less extreme/healthy based on self-report.	AHEAD survey. BMI. Project EAT survey. Additional non-standardised measures.	Designed for use with diabetic population.
2	Children's Eating Disorder Examination (cEDE). DEBs reported in last month	cEDE BMI HBA $_{1C}$ Tanner stage of development Children's Depression Inventory Global self-worth scale of the Self Perception Profile for Children. EAT-26	Yes

ID	Method of defining DEB	Measures	Measures adjusted for use with diabetic participants
3	DSM-IV diagnostic criteria. Binge eating – 12 or more episodes in past three months	EDE BMI HBA_{1C} Urinary albumin to creatinine ratio. Diabetes complications - case notes.	Yes
4	DSM-IV diagnostic criteria for AN and BN. Jones (2000) operational definitions for EDNOS and sub-threshold eating disorders.	cEDE BMI HBA_{1C} Tanner developmental measure	Yes
5	None/healthy/unhealthy/ very unhealthy weight control behaviours.	AHEAD survey Project EAT DEPS BMI HBA_{1C}	Developed for use with diabetic population.
6	DSM-IV criteria. Operationalised further diagnosis of EDNOS and sub-threshold.	EDI EAT-26 Diagnostic survey for eating disorders (modified). BMI EDE	Yes.
7	Sub-categorised according to age rather than eating status.	EDI DEBQ Insulin Questionnaire	Yes.
8	DSM-III criteria. Maladaptive eating behaviour included insulin manipulation, and failure to follow recommended diet.	HSC Blood samples. Diabetic management information sheets. HBA_{1C}	No
9	DSM-III R diagnostic criteria.	EDE BMI EAT-26 GHb levels – index of the quality of glycaemic control.	Yes – EDE only
10	DSM-III diagnostic criteria.	EDE EAT-26 Weight HBA_{1C}	Yes – EDE only Questions added for insulin manipulation

ID	Method of defining DEB	Measures	Measures adjusted for use with diabetic participants
11	DSM-III and DSM-III R diagnostic criteria	Diabetic history Weight Height HBA $_{1C}$ Diagnostic survey for ED Scale of non-compliance with diabetes management	Questions added for insulin manipulation
12	Healthy/unhealthy/very unhealthy weight loss behaviours	AHEAD DEPS Project EAT HBA $_{1C}$ BMI	Developed for use with diabetic population
13	DEBs assessed as continuous variables	Parent and adolescent measures Demographic/family history form Negative communication form Self-care inventory Diabetes self-management profile EDI-Body dissatisfaction scale EAT-26 Meter downloading. EDE-D	EDE-D developed specifically for use with a diabetic population.
14	Categorised into healthy/unhealthy weight loss practices	BMI Weight related issues assessed using questions similar to the Youth Risk Behaviour Surveillance System A1C – glycaemic control	Yes

ID	Sample size	Age/sex of participants	Reliability/ Validity	Data Analysis
1	143 (58% response rate) 4746 controls (81.5% response rate)	12-21 Females and Males	No reliability/validity info given	Chi-square Logistic regression
2	126/177 (71%) - time 1. 106/126 (84%) - time 2.	9-13 Females	Inter-rater reliability 0.93-0.99. EDE - acceptable inter-rater reliability, test-retest reliability, and discriminant validity.	Student's t-test McNemar Change test Matched t-tests for Linear regression. ANOVA

ID	**Sample size**	**Age/sex of participants**	**Reliability/ Validity**	**Data Analysis**
3	54 (90%) at baseline, 37 (69%) re-interviewed 33 (88%) at baseline, 26 (79%) were re-interviewed	17-25,1987-1988 11-18, 1989-1990. 20-27, 1997-1998 28-38, 1999-2000 Females	EDE - established reliability and validity	Mann-Whitney test Chi-square t-test
4	101 of 142 (71%), 439 of 655 (67%) control group.	9-13 Females	Inter-rater reliability 0.93-0.99. EDE - acceptable inter-rater reliability, test-retest reliability, and discriminant validity. cEDE not validated in this young age group	Student's t-test. Chi-square
5	143 of 246 (58%)	12-21 Males and females	No measures given.	Chi square ANOVA
6	361 of 430 (84%) with Type 1 diabetes. 1840 of 2494 (74%) controls.	12-19 Females	EDI and EAT-26 are reliable and valid measures.	Chi square Student's t-test ANOVA Independent t-tests
7	48 of 57. 42 controls	13-20 Females	EDI reliable and valid measure. No info given for the DEBQ.	ANOVA
8	79	44 girls, 35 boys 8.2-13.8. Last assessment 16-26.5.	Inter-rater reliability was satisfactory.	Stepwise multivariate logistic regression.
9	76 of 86 (88%). 76 of 89 (85%) controls	11-18 Females and Males	EDE has established reliability and validity.	Chi square Student's t-test
10	103 of 114 (90%) diabetics. 54 women/46 men administered the EDE. 67 controls	17-25 Females and Males	EDE and EAT-26 - established reliability and validity	Chi square t-tests
11	103 of 121 (85%).	13-18 Females	No reliability and validity measures given	Chi square Student's t-test One-tailed t-test

ID	**Sample size**	**Age/sex of participants**	**Reliability/ Validity**	**Data Analysis**
12	295 of 780 (38%)	Mean age of 14.9 158 males/137 females	Established reliability/validity No reliability and validity data available for Project EAT	Spearman correlation Independent sample t-tests Chi-square Stepwise multiple regression
13	75 of 90 (83%)	11-17 Females	Negative communication–0.49-0.88, acceptable convergent validity. Self care inventory – 0.87 Diabetes self-management profile - 0.76 EDI reliable/valid for use with population. EAT-26 - good test-retest reliability/sensitivity/specificity EDE-D – 0.68-0.82. Acceptable discriminant validity.	Hierarchical Multiple regression
14	1742 female and 1615 males. 84.5% had T1DM	Mean age of 15 years Females and Males	No reliability/validity measures	Multiple regression

1D	**Prevalence of insulin omission**	**Prevalence of Insulin misuse**	**Frequency/severity of insulin omission/misuse**	**BMI measurements**
1	10.3% girls 1.4% boys	7.4% girls 1.4% boys	Behaviour had to occur over past year.	Two groups not dissimilar on BMI
2	-	1% 1/106 at time 2. Insulin manipulation	Had to occur once in last month	Higher BMI predicted higher prevalence of DEB
3	-	31 subjects (36%) engaged in insulin omission or insulin manipulation.	Had to have been used at least once as a weight control strategy	BMI did not mediate body satisfaction in those with DEB
4	2 of 101 (2%)	-	Had to occur once in previous month	Not investigated

1D	Prevalence of insulin omission	Prevalence of Insulin misuse	Frequency/severity of insulin omission/misuse	BMI measurements
5	10.3.% Mostly females	7.4% - less insulin taken Only one male reported insulin misuse	Had to occur in past year	BMI not associated with prevalence of very unhealthy weight control behaviours
6	-	41 (11%) taking less than prescribed insulin	Had to be currently engaging in behaviour.	Mean BMI diabetes 22.7, 20.6 non-diabetics.
7	11 (22.9%) currently/had been omitting insulin injections. No difference with age.	-	Had to be more than once a month, either past of present.	-
8	-	6 (7.6%) with DEB met diagnosis for pervasive non-compliance with insulin.	One or more daily doses of insulin	-
9	-	5 (15%) Omitting or reducing dose	Taking no insulin during a 24 hour period. OR Taking less insulin than prescribed on at least two occasions during past month	Not discussed in relation to insulin manipulation. Two groups did not differ in terms of BMI. Girls with IDDM had significantly higher BMI than IDDM boys.
10	-	20/54 (37%) had under dosed or omitted in past 6/54 (11%) were currently doing No insulin manipulation reported in men	Frequency varied greatly	-
11	-	12% history of omission or reduction of dose	-	-
12	1.4%	1%	-	BMI significantly higher for those reporting weight control behaviours

1D	Prevalence of insulin omission	Prevalence of Insulin misuse	Frequency/severity of insulin omission/misuse	BMI measurements
13	30.7% missing insulin doses once a month or less 12% missed insulin doses once a week or less 9.3% missed insulin doses more than once a week	13.3% took less than prescribed one to three times per three month period. 5.3% took less insulin than prescribed four to six times per three month period. 4% took less than prescribed more than 100 times per three month period.	Levels of frequency/severity clearly defined.	-
14	-	4.2%	-	Being obese/overweight associated with unhealthy weight loss practices/self perception of overweight/trying to lose weight/worry about weight.

ID	Reason for omitting insulin	Measure of weight/shape concerns?	Separate prevalence rates given for ED/no ED?	Health outcomes
1	Weight loss/management	One scaling question asking about weight satisfaction. Those engaged in insulin omission more likely to report body dissatisfaction.	No	-
2	Weight control	-	No ED found in sample 1% non-ED sample	No relationship between eating status and glycaemic control

ID	Reason for omitting insulin	Measure of weight/shape concerns?	Separate prevalence rates given for ED/no ED?	Health outcomes
3	Weight control	Significant difference in baseline EDE scores for shape concern/weight concern/dietary restraint between subjects with and without history of insulin misuse, independent of body weight. Significant relationship between hospital admissions and weight/shape concerns/dietary restraint	Those with disordered eating, 14 (61%) reported insulin misuse 11 (26%) subjects without history of DEB	Serious micro vascular complications - 11 (48%) had history of insulin misuse. Significant relationship between two or more serious complications and insulin misuse Strong relationship between hospital admission with DKA and insulin misuse
4	Weight control Incidences of insulin omission for other reasons were eliminated	-	Sample included those with a diagnosis of EDNOS.	-
5	Weight control	Very unhealthy weight management behaviours reported highest levels of weight dissatisfaction DEPS scores were associated with weight dissatisfaction, not BMI or weight perception	-	Very unhealthy weight management behaviours - higher HBA_{1C}.
6	Weight loss	Not included	42% of diabetic subjects with ED reported insulin omission. 18% in sub threshold 6% in non-disordered group	Those with a DSM-IV ED had higher mean HBA_{1C}

7	-	Diabetics had higher scores for drive for thinness/body dissatisfaction. Body dissatisfaction increased with age. Those who omit insulin did not have higher scores on drive for thinness.	All participants scored within normal ranges for the EDI.	-
8	-	-	6 with eating problems and no ED. 3 with both ED and eating problems.	-
9	Weight control	-	One of 5 had ED.	Most who omitted insulin had poor glycaemic control.
10	Weight control	-	4 of the 6 currently under dosing/omitting had ED	-
11	Weight loss	-	7 (54%) reported insulin omission with an ED 5 (6%) without ED Of 12 participants who omitted insulin, 7 (58%) received DSM-III diagnosis, and 3 (25%) based on DSM – III R criteria.	Insulin misuse/non-compliance may be contributing to poor metabolic control
12	Weight loss or control.	Weight satisfaction predicted DEPS score. No significant difference for insulin omission/manipulation	-	HBA_{1C} measurements - significantly higher for those who skipped insulin
13	Weight control.	Body image dissatisfaction moderated the relationship between negative communication and adolescents maladaptive eating attitudes and behaviours.	-	-
14	Weight control	-	-	-

Appendix D: Measures

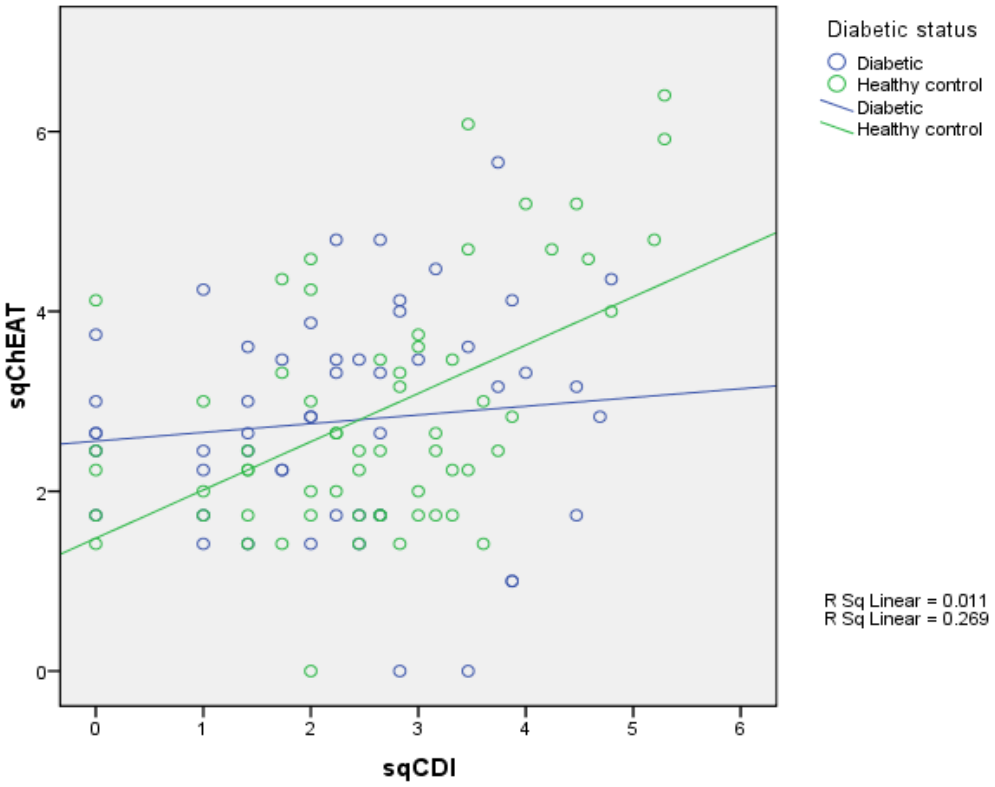
Appendix E: Participant Information Sheets for participants living with T1DM

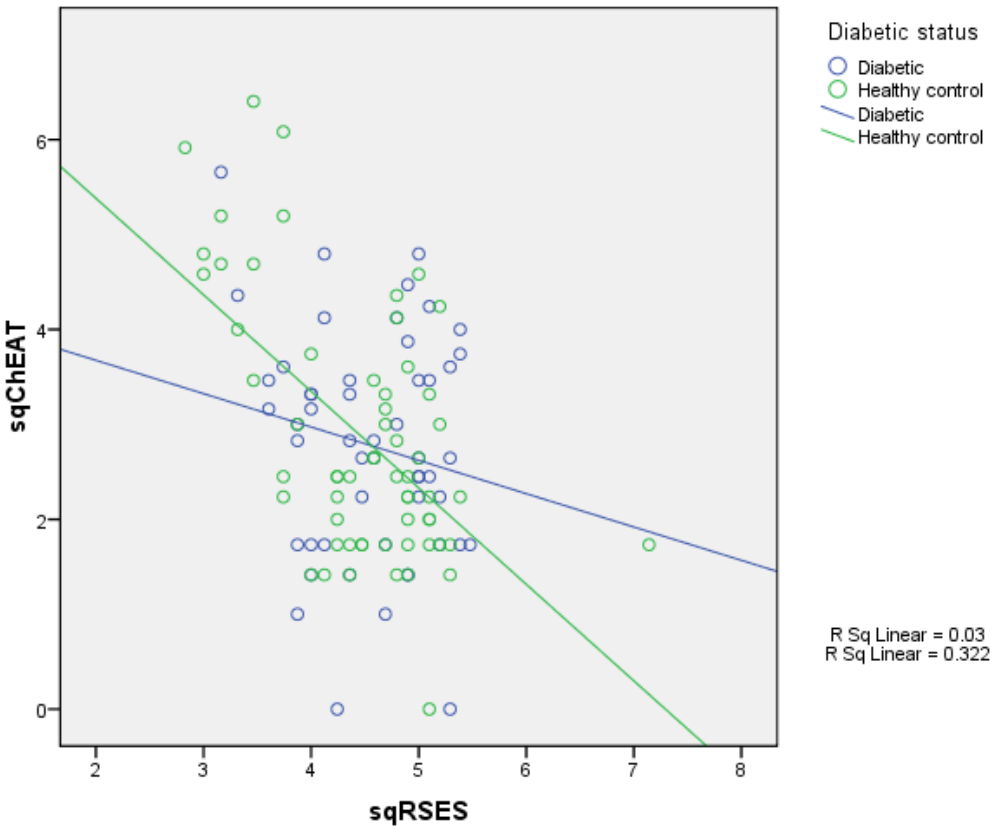
Appendix F: Participant information sheets for participants living without Diabetes

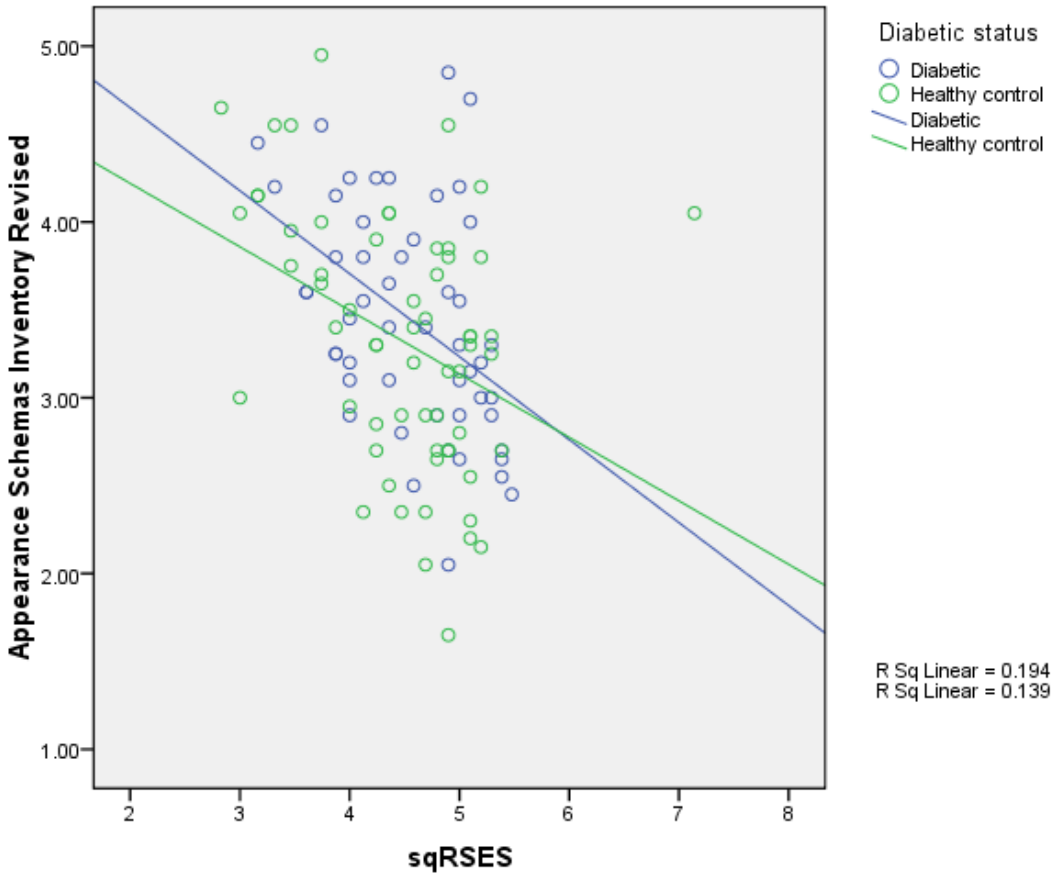
Appendix G: Ethical Approval

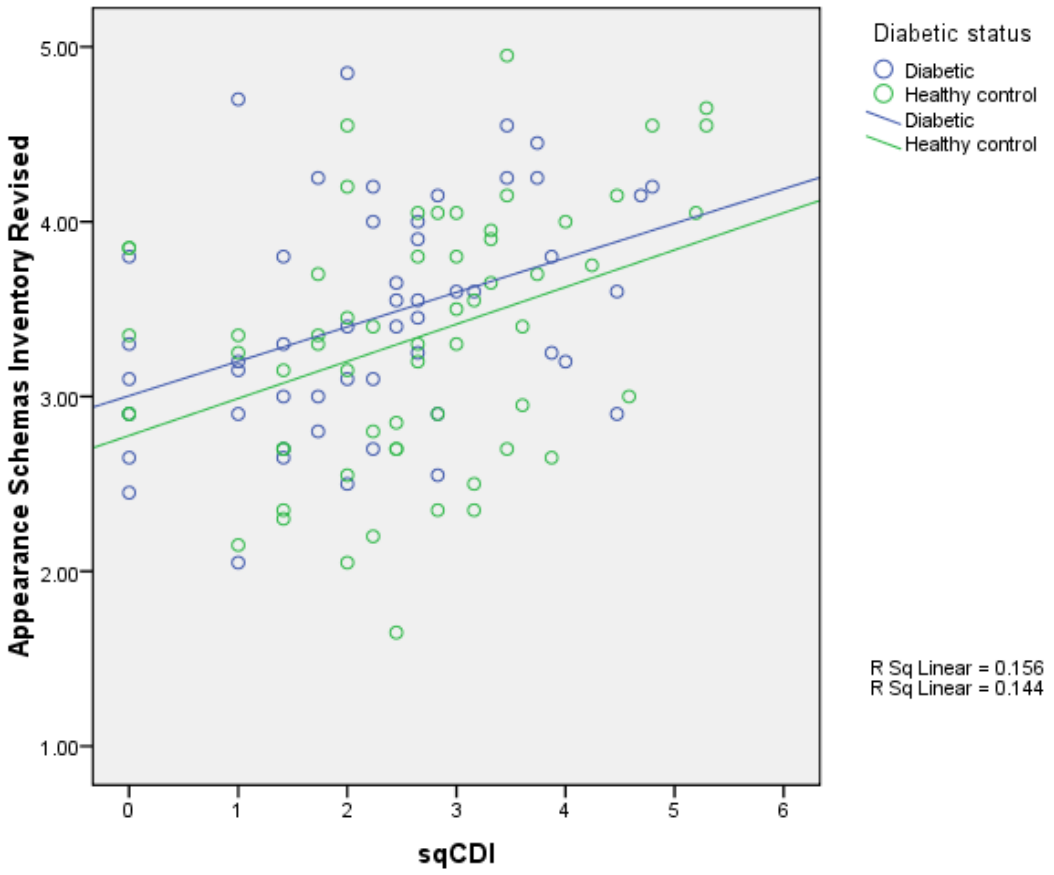
Appendix H: Output for ANCOVA's and multiple regression

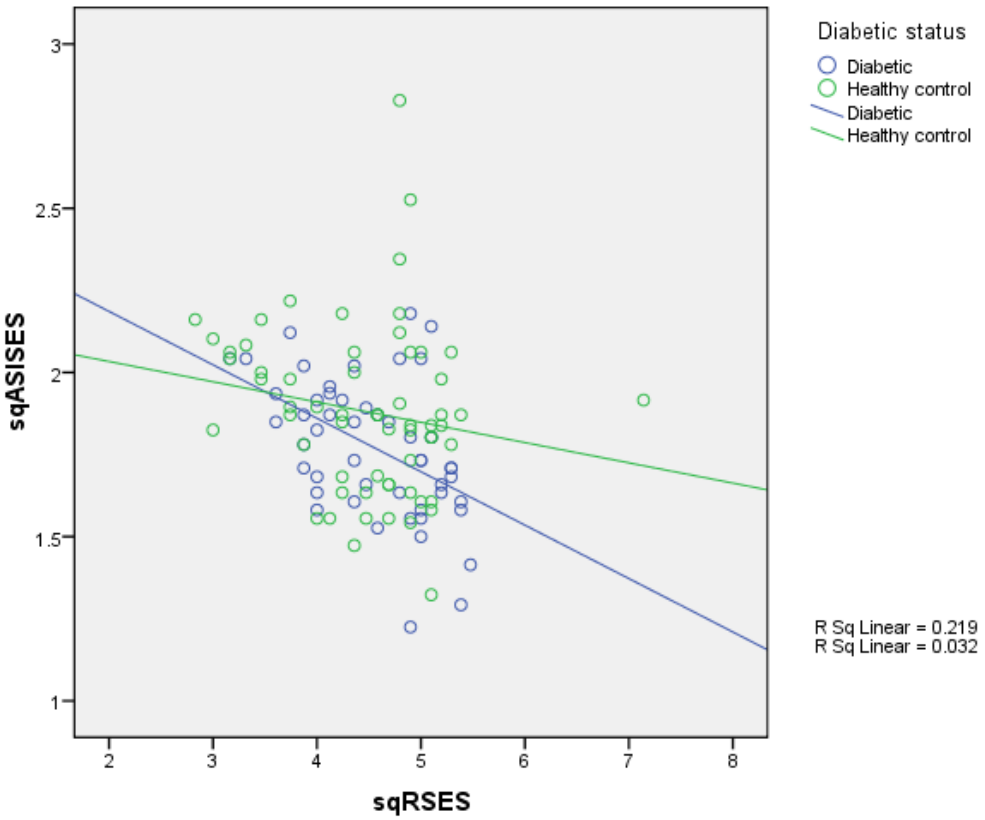
Assumptions of ANCOVA

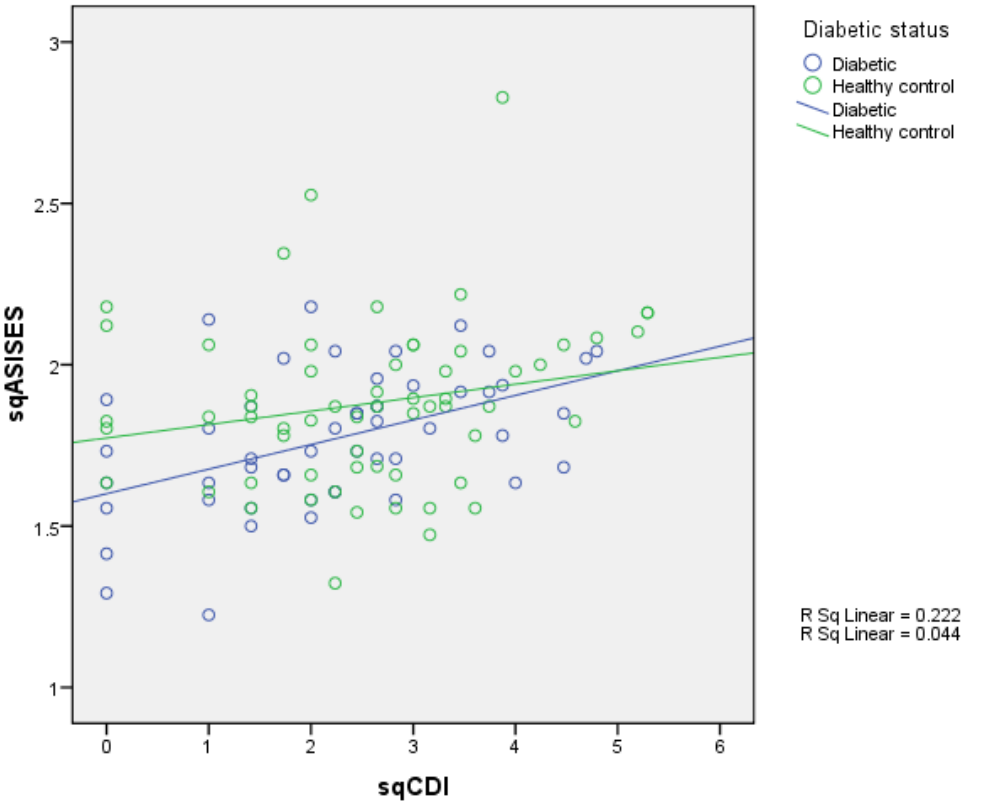




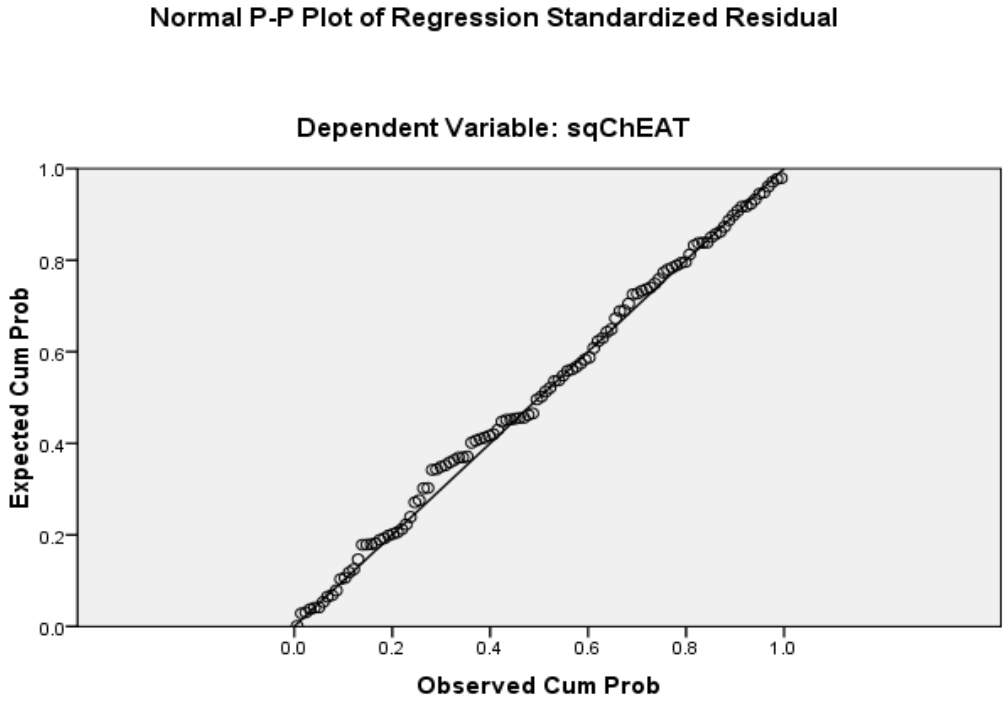

Diabetic status
Diabetic
Healthy control
Diabetic
Healthy control
R Sq Linear = 0.194
R Sq Linear = 0.139
Appearance Schemas Inventory Revised
sqRSES
5.00
4.00
3.00
2.00
1.00
2
3
4
5
6
7
8

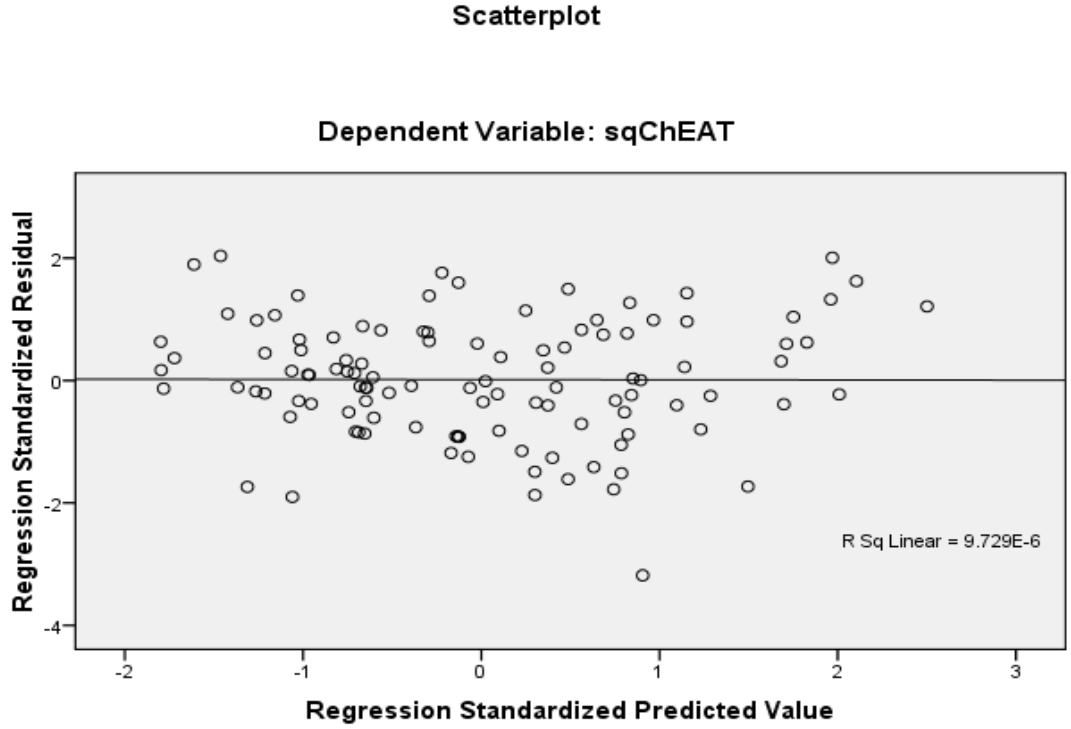

Diabetic status
Diabetic
Healthy control
Diabetic
Healthy control
R Sq Linear = 0.156
R Sq Linear = 0.144
Appearance Schemas Inventory Revised
sqCDI
5.00
4.00
3.00
2.00
1.00
0
1
2
3
4
5
6


Diabetic status
Diabetic
Healthy control
Diabetic
Healthy control
sqASISES
sqRSES
R Sq Linear = 0.219
R Sq Linear = 0.032


Diabetic status
Diabetic
Healthy control
Diabetic
Healthy control
sqASISES
sqCDI
R Sq Linear = 0.222
R Sq Linear = 0.044

Assumptions of multiple regression:





Appendix I: Additional regression analysis

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.555[a]	.309	.276	1.083

a. Predictors: (Constant), Appearance Schemas Inventory Revised, sqCDI, sqASISES, sqRSES, Appearance Schemas Invenotry Revised-Motivational Salience

ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	55.490	5	11.098	9.461	.000[a]
	Residual	124.347	106	1.173		
	Total	179.837	111			

a. Predictors: (Constant), Appearance Schemas Inventory Revised, sqCDI, sqASISES, sqRSES, Appearance Schemas Invenotry Revised-Motivational Salience

b. Dependent Variable: sqChEAT

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.538	1.453		1.058	.292
	sqRSES	-.454	.208	-.245	-2.177	.032
	sqCDI	.054	.109	.055	.490	.625
	sqASISES	.888	.628	.170	1.414	.160
	Appearance Schemas Invenotry Revised-Motivational Salience	.103	.284	.059	.362	.718
	Appearance Schemas Inventory Revised	.360	.386	.196	.932	.354

a. Dependent Variable: sqChEAT

Appendix J: Epistemological Position

The research was conducted from a **positivist** epistemology, assuming that the presence of appearance-related schema and their mediation in the development and maintenance of disordered eating were measurable through the application of reliable and valid scientific procedures to verify or falsify the hypotheses, whilst controlling for confounding variables. The methodology driven by this epistemology was therefore quantitative.

Appendix K: Chronology of research process

Research Proposal	**June 08**
Peer Review	**Dec 08**
Ethics Application submission	**May 09**
R&D application submission	**May 09**
Ethics committee meeting	**June 09**
Responding to requests from ethics committee	**June-Sep 09**
Application to Psychology ethics committee	**July 09**
Psychology ethical approval received	**July 09**
NHS Ethics approval received	**Sep 09**
Control group data collection	**Sep-Oct 09**
R&D approval received	**Dec 09**
Experimental group data collection	**Jan-April 10**
Literature review database searches	**Dec 09/Jan10**
Writing up of literature review	**Jan-Mar 10**
Writing up of research paper	**Feb-May 10**

Appendix L: Guidelines to authors for target journal

Appendix M: Glossary

AHEAD = Assessing Health and Eating among Adolescents with Diabetes Survey

AN = Anorexia Nervosa

ANOVA = Analysis of Variance

BMI = Body mass index

BN= Bulimia Nervosa

cEDE = Children's version of the Eating Disorders Examination

DEB = Disordered eating behaviours

DEBQ = Dutch Eating Behaviour Questionnaire

DEPS = Diabetes Eating Problem Survey

Diabetic Ketoacidosis (DKA) = Potentially life-threatening complication of diabetes, resulting from a shortage of insulin. Occurs in response to body switching to burning fatty acids and producing acidic ketone bodies.

EAT-26 = Eating Attitudes Test

ED = Eating Disorder

EDE = Eating Disorders Examination

EDE-D = Eating Disorders Examination-Diabetes

EDI = Eating Disorders Inventory

EDNOS = Eating Disorders not otherwise specified

Glycosuria = The excretion of glucose into the urine

HBA_{1c} = Haemoglobin A_{1C}. The average plasma glucose concentration over a prolonged period of time.

HSC = The Semi-Structured Symptom-Oriented Interview Schedule for Children and Adolescents

Hyperglycaemia = High blood sugar, when excess glucose circulates in the blood plasma

Hypoglycaemia = Lower than normal level of blood glucose in the blood plasma.

IDDM = Insulin dependent diabetes mellitus

Ketone bodies = Water-soluble compounds that are produced as by-products when fatty acids are broken down for energy in the liver and kidney.

Metabolic control = Balance between production and utilisation of glucose.

Project EAT = Project Eating Among Teens Survey