# FACTORS ASSOCIATED WITH DIETARY ADHERENCE AND QUALITY OF LIFE IN PEOPLE WITH COELIAC DISEASE

by

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## Thesis Overview

This thesis is submitted in partial fulfilment for the degree of Doctor of Clinical Psychology at the University of Birmingham. This thesis comprises of four chapters. The first chapter presents a meta-analysis assessing the effects of Third-Wave psychological interventions (Compassion Focused Therapy, Dialectical Behavioural Therapy, Acceptance Commitment Therapy, Mindfulness-based Stress Reduction and Mindfulness-based Cognitive Therapy) for people with dietary-managed chronic conditions (Type 2 Diabetes, Irritable Bowel Syndrome, Coeliac Disease, Cardiovascular Disease) across depression, anxiety, and Quality of Life outcomes. The findings showed that Third-Wave interventions may benefit people with dietary-managed chronic health conditions in reducing symptoms of depression and anxiety.

The second chapter is an empirical quantitative study, using a cross sectional design, with 458 participants who have a diagnosis of Coeliac Disease. Each participant completed a battery of questionnaires assessing; self-compassion, perfectionism, food attitudes and behaviours, adherence to a gluten-free diet and Quality of Life. Correlation, regression, and mediation analysis were conducted. Findings showed that self-compassion is an important psychological factor for healthcare professionals to consider in the management of Coeliac Disease and factors such as perfectionism and food attitudes and behaviours should be explored.

The third and fourth chapters each present a ‘press release’, that summarises the findings of both papers in an accessible format for public dissemination.

**Acknowledgements**

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**List of Abbreviations**

| | |
|---|---|
| ACT | Acceptance Commitment Therapy |
| CD | Coeliac Disease |
| CDAT | The Celiac Dietary Adherence Test |
| CD-FAB | The Coeliac Disease Food Attitudes And Behaviours Scale |
| CD-QOL | The Coeliac Disease Quality Of Life Survey |
| CFT | Compassion Focused Therapy |
| DBT | Dialectical Behavioural Therapy |
| FMPS | The Frost Multidimensional Perfectionism Scale |
| GFD | Gluten-Free Diet |
| IBS | Irritable Bowel Syndrome |
| MBSR | Mindfulness-Based Stress Reduction |
| MCBT | Mindfulness-Based Cognitive Therapy |
| NICE | National Institute for Clinical Excellence |
| ONS | Office for National Statistics |
| QoL | Quality Of Life |
| RCT | Randomised Control Trial |
| SCS | Self-Compassion Scale |
| SMD | Standardised Mean Difference |
| T2D | Type 2 Diabetes |
| TAU | Treatment As Usual |
| WHO | World Health Organisation |

**Chapter 1. Literature Review:** A Meta-Analysis Of The Effectiveness Of Third-Wave Psychological Interventions For Anxiety, Depression, And Quality Of Life In People With Dietary-Managed Chronic Health Conditions

## ABSTRACT


### Background

Individuals with a dietary-managed chronic health condition have reported higher levels of anxiety, depression, and experienced poorer Quality of Life (QoL) in comparison to the general population and those without such conditions. Third-wave psychological interventions are increasingly being used to support people with chronic health conditions but the efficacy of them in people with dietary-managed chronic health condition is yet to be investigated.

### Aims

To assess the effects of third-wave interventions (Compassion Focused Therapy (CFT), Dialectical Behavioural Therapy (DBT), Acceptance Commitment Therapy (ACT), Mindfulness-based Stress Reduction (MBSR) and Mindfulness-based Cognitive Therapy (MBCT)) for people with a dietary-managed chronic health condition, such as Type 2 diabetes (T2D), Irritable Bowel Syndrome (IBS), Coeliac Disease (CD), Cardiovascular Disease, across depression, anxiety, and Quality of Life (QoL) outcomes.

### Methods

Comprehensive searches were carried out of the following databases: APA PsycArticles, Embase, APA PsycInfo and Ovid Medline. The initial systematic search yielded 976 papers; 34 papers met the requirements of the meta-analysis. A purpose-made set of quality

criteria based on The Cochrane Collaboration Risk of Bias Tool, reviewed the quality of the papers. Following data extraction, 88 effects were found that included 2294 participants. A random effects model using the generic inverse variance method was completed.

**Results**

A standardised mean difference was found between ACT and CFT interventions for depression, with treatment effects being maintained at follow up. A standardised mean difference was found between ACT, CFT and DBT for anxiety, with treatment effects being maintained at follow-up for ACT and CFT. There was no evidence of a meaningful treatment effect for QoL.

**Conclusion**

Third-wave psychological interventions may benefit people with a dietary-managed chronic health condition in reducing depression and anxiety symptomology. However, improvements in methodology are required in future research.

# INTRODUCTION

## Chronic Health Conditions

Approximately 1 in 3 adults experience multiple chronic health conditions worldwide (Hajat & Stein, 2018) and chronic health diseases kill 41 million people each year which is equivalent to 74% of deaths globally (WHO, 2022). In 2020, the UK spent £54.1 billion on the physical management of chronic health conditions (ONS, 2020). The burden of chronic health diseases is rapidly increasing in most countries (Hvidberg et al, 2020). Chronic health conditions are permanent, incurable diseases (Roddis et al, 2016) caused by pathological changes in the body (Dunn-Cane, 2002), that are mainly controlled and managed by medical interventions (NICE, 2023); examples include: cancer, cardiovascular disease, diabetes, epilepsy and certain gastrointestinal conditions (Whittemore & Dixon, 2008).

People with chronic health conditions are more likely to experience depression (Birk et al, 2019), anxiety (Lebel et al, 2020) and poorer Quality of Life (QoL) (O'Dwyer et al, 2021) than those without one. The factors contributing towards this include; loneliness, poor health outcomes and lack of access to appropriate treatment (Li et al, 2019). Recent longitudinal findings suggest the co-occurrence of depression and anxiety is associated with higher accumulation rates of chronic health conditions (Bobo et al, 2022). Having comorbid mental and chronic health conditions can lead to premature deaths (Erlangsen et al, 2017), increased suicide risk (Gürhan et al, 2019), social isolation, low self-esteem, discrimination, and increased use of healthcare services (Brettschneider et al, 2013). As people with chronic illnesses are more likely to experience mental health symptoms and poorer QoL, it is important to investigate the psychological interventions which may be effective.

## The Concept of Dietary Managed Chronic Health Conditions

The majority of literature on chronic health conditions tends to focus on cancer, neurological conditions, and pain management. An under-researched area within physical health that impacts psychological functioning are "dietary-managed" chronic health conditions. After extensive research, it was observed that the term "dietary-managed" is infrequently used, despite certain chronic health conditions requiring significant dietary adaptations, often in conjunction with other medical interventions. The most common of these conditions requiring meticulous dietary self-management are Coeliac Disease (CD) (Muhammad et al, 2019), Type 2 Diabetes (T2D) (Magkos et al, 2020), Cardiovascular Disease (Brandhorst & Longo, 2019), and Irritable Bowel Syndrome (IBS) (Weber, 2022). Dietary self-management often requires an individual to make significant adaptations and consider their choices of food and beverages consumption, often requiring lifestyle changes and considerable financial implications (Vitolins & Case, 2020). The process of dietary self-management and /or adherence to specific 'diets' can make some individuals feel anxious, depressed and impact their QoL (Barberis et al, 2019).

### *Coeliac Disease*

CD is an auto-immune condition, effecting multiple organs such as the liver, nervous system, and skin (Rostom et al, 2006). The consumption of gluten, a protein found in wheat, barley and rye (Mcgough & Cummings, 2005) results in intestinal malabsorption and chronic inflammation of the small intestine. The only available treatment is a lifelong, strict gluten-free diet as adherence to a gluten-free diet reverses damage to the gut. Since gluten is found in the majority of staple foods (i.e., bread, pasta, cereals and some alcoholic beverages such as beer), adherence can be restrictive and challenging (Makharia et al, 2022) in addition to risks of cross-contamination. People with CD are at an increased risk of depression, anxiety and eating

disorders (Clappison et al, 2021). Guedes et al. (2020) found 62.7% of people with CD have anxiety and 34.9% have depression, and this was associated with difficulties in managing the gluten-free diet, comorbidity with other diseases and perceived lack of control associated with having the disease. Furthermore, the dietary management of CD can be burdensome and impact QoL due to the reduced availability and higher costs of gluten-free foods, for example gluten-free bread was found to be 400% more expensive (Hanci et al, 2019).

### *Type 2 Diabetes*

Type 2 Diabetes (T2D) is an insulin-resistant condition that typically appears in people with obesity and higher body fat levels. Historically, T2D was found predominantly in adults over the age of 45 (Carrillo-Larco & Bernabé-Ortiz, 2019). In recent years, due to an increase in obesity and inactivity, T2D is more frequently seen in children and young people (Goyal et al, 2022). The dietary management of T2D requires controlling carbohydrates, sugars and fibres which is critical in controlling haemoglobin (HbA1c) levels to prevent further complications such as blindness (Stark Casagrande et al, 2013). Self-management of diabetes can impact functioning and QoL (Harding et al, 2019) with 19% of people with T2D meeting the criteria for depression (Farooqi et al, 2022). Depression and diabetes-distress (worry, frustration and anger) are both associated with increased mortality, poorer health outcomes (Fisher et al, 2008), and can lead to further health complications such as coronary heart disease and stroke (Katon et al, 2010).

### *Cardiovascular Diseases*

Cardiovascular Diseases are the leading cause of death globally, accounting for 32% of all deaths worldwide (WHO, 2021). Coronary Heart Disease (CHD) is often linked to an unhealthy diet, causing blockages of the arteries supplying oxygen to the heart and brain that

can eventually cause heart attacks and strokes (Sanchis-Gomar et al, 2016). Alongside drug administration such as statins, the management of Cardiovascular Disease requires a person to undertake lifestyle and dietary changes such as adherence to a low sodium, sugar and low red-meat diet (Sharifi-Rad et al, 2020), increasing the consumption of fruits and vegetables, and the reduction of dietary fats (Bhupathiraju et al, 2013). A bidirectional relationship between CHD and depression has now been established (De Hert et al, 2018). The prevalence of depression in people with CHD is significantly higher by approximately 20-25%, than the general population (Whooley & Wong, 2013) and having an anxiety disorder increases the risk of developing CHD by 41% (Emdin et al, 2016).

### *Irritable Bowel Syndrome*

Irritable Bowel Syndrome (IBS) is defined as a functional gastrointestinal bowel disorder that is associated with changes in the frequency of bowel movement and abdominal pain (Camilleri, 2001). Similar to other chronic health conditions, a bi-directional relationship between IBS, anxiety and depression has been established due to psychological and biological factors potentially impacting the gut-brain relationship (Oudenhove et al, 2016), consequently affecting overall QoL (Chan et al, 2022). There is also evidence to suggest anxiety is more common for those in the early stages of the disease and depression is more common in those with chronic symptoms of IBS (Gros et al, 2009). In recent years the mechanisms of dietary intake have been extensively researched in people with IBS, with the low FODMAP diet being recommended as the first-line intervention (Gibson, 2017). The FODMAP diet is a three-step elimination diet involving avoidance, reintroduction and identification of foods which may be aggravating the gut; the diet typically involves avoiding diary-based items, wheat products, certain fruits, vegetables and beans (Marsh et al, 2016). The process and adherence to the diet have been found to cause distress and impact overall lifestyle (Halmos, 2017).

## Third-Wave Psychological interventions & Chronic Conditions

Third-Wave psychotherapies, derived from a 'newer' generation of Cognitive-Behavioural Therapies (CBT) comprise of a 'heterogeneous group' of behavioural therapies which incorporate concepts such as: mindfulness, self-compassion and acceptance (Kahl et al, 2012). Although there is debate as to what therapies are classed as 'Third-Wave', experts in the field (Hunot et al, 2013; Kahl et al, 2012; Ost, 2008) commonly suggest these are: Acceptance and Commitment Therapy (ACT) (Hayes & Hofmann, 2021), Compassionate Focused Therapy (CFT) (Gilbert, 2010), Mindfulness-based Cognitive Therapy (MCBT), Mindfulness-based Stress Reduction (MBSR) (Teasdale et al, 2000) and Dialectical Behavioural Therapy (DBT) (Linehan, 1993).

The use of third-wave psychological therapies is increasingly being considered for the treatment of long-term health conditions (Graham et al, 2016) and associated difficulties such as stigma, isolation, medical mistrust, adherence, and powerlessness which can all lead to depression and anxiety (Segal, 2002). A stepped-care protocol for treating individuals with depression and chronic health conditions, beginning with low-intensity CBT, has been outlined and recommended (NICE, 2021). However, in the past decade, Third-Wave therapies for depression and anxiety in people with chronic health conditions are increasingly being utilised in clinical practice (Karekla et al, 2019).

### *Acceptance and Commitment Therapy*

Unlike traditional CBT, ACT views distress as an inevitable part of living and the approach aims to introduce psychological flexibility (Graham et al, 2016). An emphasis is placed on living a 'valued life' (Pearson & Hayes, 2012) and engaging in values-driven activities (McCracken & Vowles, 2014). Using metaphors, experiential exercises and the acceptance of troublesome experiences, clients are encouraged to embrace distressing thoughts,

emotions, and bodily sensations (Hayes et al, 2012). Given that distress and negative health beliefs can be common responses to living with chronic health conditions, the theoretical underpinnings of ACT would encourage values-based living whilst accepting difficult thoughts and feelings, in contrast to cognitive restructuring in traditional CBT (Graham et al, 2016).

The utilisation of ACT over other psychological approaches has grown in the past decade (Lanzaro et al, 2021), and is widely being adopted by healthcare professions within clinical practice (Thewes et al, 2014). A meta-analysis of three studies (Sakamoto et al, 2022) looking into the efficacy of ACT in people with T2D found ACT can support in the reduction of glycated haemoglobin and increase self-care ability and acceptance. Other studies have reported improvements in female 'mental health' with T2D after eight sessions (Kaboudi et al, 2017) and improvements in pain acceptance and pain perception in people with painful diabetic neuropathy (Taheri et al, 2020). In cancer patients, a meta-analysis (Li et al, 2021) of seventeen studies found ACT was associated with increased outcomes for depression, anxiety and QoL and the effects were maintained at the six-month follow up. Despite its increasing use within physical healthcare settings, research into the impact of ACT on depression, anxiety and QoL in people with dietary-managed conditions is still limited.

### *Mindfulness Approaches*

Mindfulness is typically understood as a form of focused awareness training that is intentional and directed to focusing on the present moment with a specific motivation of not judging and evaluating the content of thoughts (Girma, 2005; Hick et al, 2010). Mindfulness-based Cognitive Therapy (MBCT) and Mindfulness-based Stress Reduction (MBSR) have considerable overlap, and both have been used to prevent relapse in recurrent depression (Siegel et al, 2002). MBCT involves a combination of CBT, meditation, and the cultivation of a present-oriented, non-judgmental focus (Sipe & Eisendrath, 2012). MBSR is an eight-week

programme using mindfulness to teach present-moment living and healthier responses to distress (Kabat-Zinn, 2003).

Both MBCT and MBSR are widely used for depression and anxiety disorders and to support people with chronic health conditions. A meta-analysis (Zou et al, 2021) of nine studies showed that mindfulness-based interventions significantly reduced depression and stress, but not anxiety in people with Cardiovascular Disease. Another meta-analysis in people with Cardiovascular Disease who had received mindfulness interventions, reported improvements in depression, stress and anxiety (Scott-Sheldon et al, 2020). MCBT has also been found to improve QoL (Henrich et al, 2020) with effects being maintained at a six-month follow-up (Zernicke et al, 2013).

### *Compassion Focused Therapy*

Compassion Focussed Therapy (CFT) focuses on the role of self-compassion (Gilbert et al, 2009). People with high levels of shame and self-criticism often struggle in being kind to themselves and are prone to high levels of shame and self-criticism, finding it difficult to generate feelings of safeness and warmth in their relationships with others and themselves.

Self-compassion has been shown to positively impact immune functioning, physiological responses to stress (Pace et al, 2009) and increase parasympathetic activity related to pain modulation (Rockliff et al, 2008). CFT also has evidence in reducing psychological symptoms in acquired brain injury (Ashworth et al, 2015), in persistent pain (Gooding et al, 2020) and improving overall mental health in people with chronic health conditions (Carvalho et al, 2021). A meta-analysis (Mistretta & Davis, 2022a) of twenty-one studies found self-compassion training improved self-compassion in people with chronic health conditions; however, the effect size was small and studies were low in quality. CFT has been

found to improve symptoms of depression in people with diabetes, and CFT was found to reduce levels of distress in an Iranian population with IBS (Mazi et al, 2020).

### *Dialectical Behavioural Therapy*

Dialectical Behavioural Therapy (DBT) was originally developed for suicidal people with borderline personality disorder (Lineham, 1993), derived from unsuccessful attempts to treat chronically suicidal individuals (Linehan, 2001). DBT is based on the skills deficit model which teaches a broad spectrum of skills within four modules; mindfulness, distress tolerance, interpersonal effectiveness, and emotional regulation (Kahl et al, 2012; McKay, 2007). Despite it being a predominantly manualised programme, modifications have subsequently been made for treating addictions, eating disorders and for use in clinical health settings, as it has demonstrated effectiveness in 'difficult to reach' patients (Lynch & Mendelson, 2003). DBT promotes QoL improvements with a specific focus on 'treatment-interfering behaviours' such as non-adherence.

In adolescents with chronic kidney disease, DBT improved symptoms of depression (Hashim et al, 2013) and DBT was found to be effective in the reduction of anxiety in patients with T2B (Montazernia et al, 2015). Current research into DBT for chronic health conditions is limited, however it is increasingly being used within this population.

## *Overview of Third-Wave Interventions*

The aforementioned third-wave psychological interventions have a commonality in that the underlying intention is to encourage acceptance and openness towards distress as opposed to avoidance and suppression. Despite CBT being the most recommended psychological intervention for people with chronic health conditions and comorbid depression and anxiety (NICE, 2023), practitioners have been found to use and integrate third-wave interventions

increasingly in people with chronic health conditions with promising results for managing symptoms of depression and anxiety (Berk et al, 2018). Unlike CBT which has been the subject of several recent meta-analyses for chronic health conditions (Li et al, 2021; Li et al, 2022), at the time of writing, no studies to date have conducted a meta-analysis on dietary-managed conditions and third-wave interventions. Thus, the aims of this meta-analysis were as follows:

(i) To conduct a systematic search of the literature, to identify papers that report anxiety, depression and QoL outcomes in people with a dietary managed chronic health condition who received a third-wave psychological intervention.

(ii) To perform a meta-analysis to determine if third-wave interventions are effective for anxiety, depression and QoL in people with a dietary managed chronic health condition.

## METHODS

### Search Strategy

A systematic search of the literature was carried out in October 2022 using the following electronic databases: APA PsycArticles, Embase, APA PsycInfo and Ovid Medline. The aim of the search was to obtain a comprehensive overview of the literature available exploring the effectiveness of third-wave psychological interventions for dietary managed chronic health conditions. Specific terminology for each research database was used and search terms were 'exploded' to capture relevant papers. Other relevant literature in the form of meta-analysis papers were consulted to derive the search terms and inform the search strategy (Table 1.) Only papers published in peer reviewed journals were considered. The search terms used to identify the studies are outlined in Table 1.

**Table 1**

*Search Criteria*

| Construct | Free Text Search Terms | References used to inform search strategy | Method of Search | Limits |
|---|---|---|---|---|
| Coeliac Disease | "Coeliac" [OR] "Celiac" | (Elfström et al, 2014) | Free search terms<br><br>All search terms combined with AND All fields | Peer reviewed articles 1967-October 2022 |
| Type 2 Diabetes | "Diabetes" [OR] "Type 2 Diabetes" | (Ismail et al, 2004) | | |
| Irritable Bowel Syndrome | "IBS" [OR] "Irritable Bowel Syndrome" | (Lackner et al, 2005) | | |
| Cardiovascular Disease | "Cardiovascular*" [OR] "Heart Disease" | (Linden et al, 2007) | | |
| Acceptance and Commitment Therapy | "Acceptance and Commitment Therapy" [OR] "ACT" | (Dochat et al, 2021) | | |
| Dialectic Behavioural Therapy | "Dialectic Behavioural Therapy" [OR] "Dialectic Behavioral Therapy" [OR] "DBT" | (Kothgassner et al, 2021) | | |
| Mindfulness | "Mindfulness*" [OR] "MCBT" [OR] "MBSR" | (Bohlmeijer et al, 2010) | | |

| | | |
|---|---|---|
| Compassion Focused Therapy | "Compassion Focused Therapy" [OR] "CFT" | (Thomason & Moghaddam, 2021) |

**Inclusion and Exclusion Criteria**

This meta-analysis included studies with participants that had a diagnosis of one of the following chronic health conditions: Type 2 Diabetes, Cardiovascular Disease, Coeliac Disease, and IBS. These conditions were included as they all require significant dietary adaptations and adherence to specific diets to manage the condition. Although there are other chronic health conditions that encourage dietary changes, the chosen conditions for review can predominantly be managed through dietary adaptations. This meta-analysis is focused on an adult population; therefore, participants of studies were required to be over the age of 18. Studies which were not peer-reviewed were excluded, this included all published systematic reviews, meta-analyses, and qualitative studies. Table 2 presents the full inclusion and exclusion criteria.

**Table 2**

*Study Inclusion And Exclusion Criteria*

| Inclusion criteria | Exclusion Criteria | Justification |
|---|---|---|
| ***Nature of intervention*:** | | |
| Must have a control group that is receiving treatment as usual (e.g., routine appointments with a healthcare professionals), on a control waiting list OR participants are receiving another third-wave psychological intervention (ACT, DBT, CFT, MCBT, MBSR). | All studies that do not have a comparator group. | All studies must have a control group to allow for analysis of the psychological intervention, without a control group this would be impossible to measure. |
| All modes of delivery, including online, individual and group. | | This meta-analysis is looking broadly at the effectiveness of third-wave interventions for dietary managed conditions therefore all modalities of delivery have been included. |
| The intervention can be delivered by any healthcare professional or student. | CBT interventions. | To meet the scope of the question, facilitators from various professional backgrounds were included e.g., therapy delivered by nurses, psychologists, and students |
| The intervention must be a third-wave intervention e.g., ACT, CFT, MCBT, MBSR or DBT. | | CBT interventions are excluded as this is not considered as a third-wave intervention. Mindfulness based CBT is included as this is classified as a third-wave intervention and primarily focuses on mindfulness. |
| ***Participant characteristics*** | | |
| All participants must have: T2D, Cardiovascular Disease, CD or IBS. | Other chronic health conditions such as:<br>IBD<br>Type 1 Diabetes<br>Diabetic Neuropathy<br>Carers with a LTC. | Type 1 Diabetes is excluded as this is not a dietary managed long-term condition. CD requires individuals to adhere to a gluten-free diet. Cardiovascular Disease requires individuals to have a balanced diet that is low in sodium, sugars, and saturated fats.<br><br>Other chronic health conditions that do not require dietary changes were excluded. |
| All participants must be over the age of 18. | Child and adolescent population groups. | The study is looking at the effectiveness of interventions in adults. |
| All nationalities. | | Participants from all countries were included. |

| Inclusion criteria | Exclusion Criteria | Justification |
|---|---|---|
| More than one long-term health condition diagnosis. | | Papers were not excluded if participants had a diagnosis of other chronic health conditions e.g., arthritis. This is because co-morbidity is very common in chronic health conditions. |
| ***Type of article*** | | |
| Papers in English. | Unavailable in English. | All papers that were not available in English were excluded due to limited resources for translation. |
| RCT's, randomised trials and non-randomised trials.<br><br>Papers must have been peer-reviewed. | Meta-analysis/theoretical papers/ reviews/commentaries/ clinical guidance/non-outcome focused studies i.e., longitudinal/association studies/case studies/validation of psychometric scales/qualitative papers. | These articles do not provide the outcome data needed for the meta-analysis.<br>This is because non peer-reviewed papers may not have gone through a review process. Articles must have been peer-reviewed to ensure high-quality research is included. |
| ***Outcome Data*** | | |
| Measures of anxiety, depression, or QoL. | | The outcomes being investigated are anxiety, depression, and QoL. These outcomes can be secondary outcomes in addition to other outcomes reported in the included studies. |
| Study sample sizes of N>10, | | This is to ensure that an effect size can be calculated and increases methodological rigour of studies included. |

**Systematic Search Results**

Figure 1 presents the PRISMA diagram showing the results of the systematic search. The search yielded a total of 976 articles and then 780 once duplications were removed. Articles were first screened by title, and any titles that mentioned other chronic health conditions such as cystic fibrosis or multiple sclerosis were excluded as were qualitative and non-peer reviewed papers. Following this, papers were then screened by abstract. The most common reasons for exclusion were papers which measured other outcomes such as emotional regulation, hopelessness, or those papers which included child and adolescent populations and other

chronic health conditions. Finally, the full-text of 161 papers were reviewed against the inclusion criteria. The most common reasons for exclusions were studies that utilised a combination of third-wave therapies, for example, ACT in combination with CBT and studies that did not have a control group. There were no additional studies identified whilst screening the references of the chosen studies. A total of 34 studies were included.

**Figure 1**

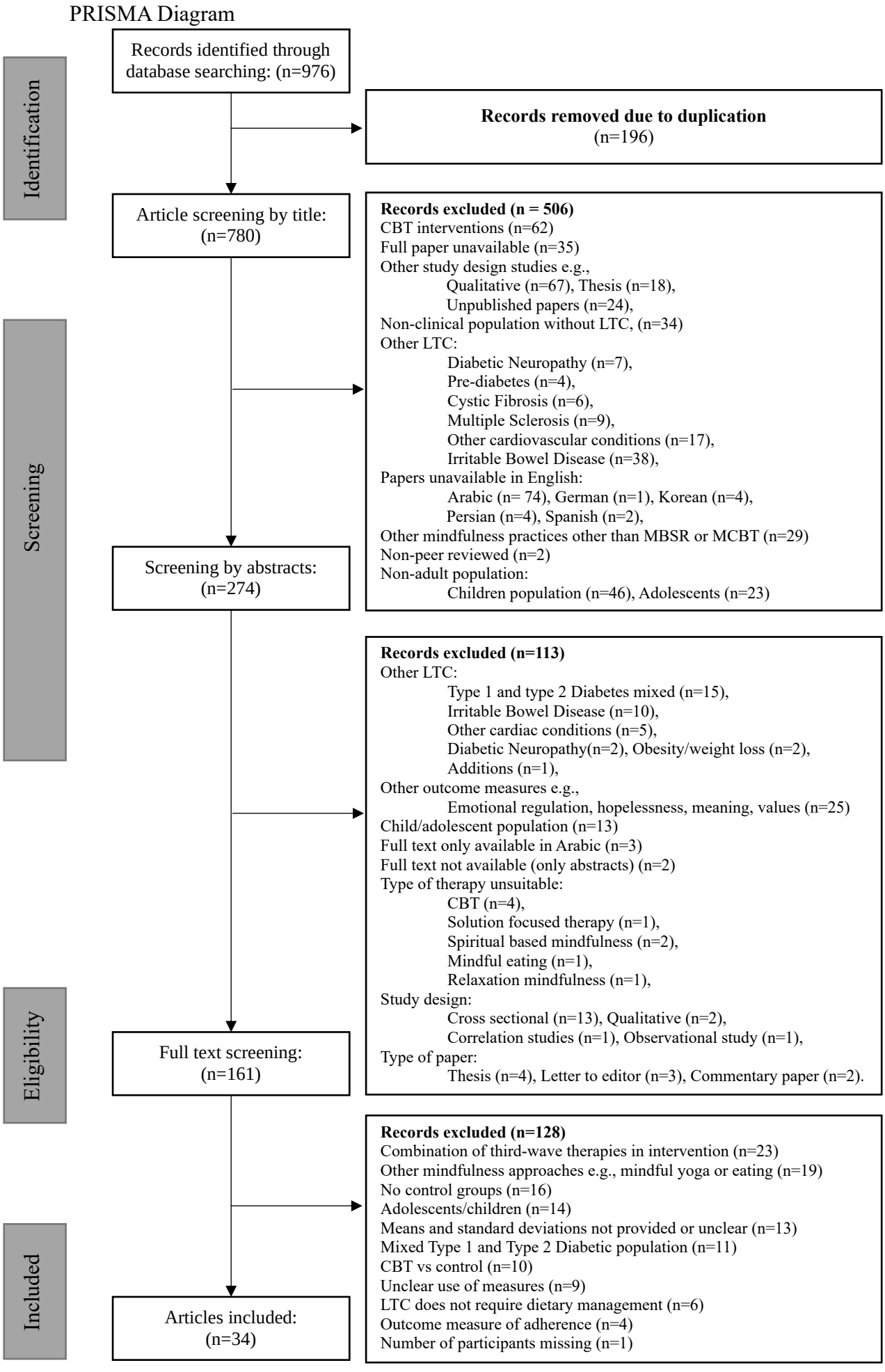

PRISMA Diagram
Identification
Screening
Eligibility
Included
Records identified through database searching: (n=976)
Records removed due to duplication (n=196)
Article screening by title: (n=780)
Records excluded (n = 506)
CBT interventions (n=62)
Full paper unavailable (n=35)
Other study design studies e.g.,
Qualitative (n=67), Thesis (n=18),
Unpublished papers (n=24),
Non-clinical population without LTC, (n=34)
Other LTC:
Diabetic Neuropathy (n=7),
Pre-diabetes (n=4),
Cystic Fibrosis (n=6),
Multiple Sclerosis (n=9),
Other cardiovascular conditions (n=17),
Irritable Bowel Disease (n=38),
Papers unavailable in English:
Arabic (n= 74), German (n=1), Korean (n=4),
Persian (n=4), Spanish (n=2),
Other mindfulness practices other than MBSR or MCBT (n=29)
Non-peer reviewed (n=2)
Non-adult population:
Children population (n=46), Adolescents (n=23)
Screening by abstracts: (n=274)
Records excluded (n=113)
Other LTC:
Type 1 and type 2 Diabetes mixed (n=15),
Irritable Bowel Disease (n=10),
Other cardiac conditions (n=5),
Diabetic Neuropathy(n=2), Obesity/weight loss (n=2),
Additions (n=1),
Other outcome measures e.g.,
Emotional regulation, hopelessness, meaning, values (n=25)
Child/adolescent population (n=13)
Full text only available in Arabic (n=3)
Full text not available (only abstracts) (n=2)
Type of therapy unsuitable:
CBT (n=4),
Solution focused therapy (n=1),
Spiritual based mindfulness (n=2),
Mindful eating (n=1),
Relaxation mindfulness (n=1),
Study design:
Cross sectional (n=13), Qualitative (n=2),
Correlation studies (n=1), Observational study (n=1),
Type of paper:
Thesis (n=4), Letter to editor (n=3), Commentary paper (n=2).
Full text screening: (n=161)
Records excluded (n=128)
Combination of third-wave therapies in intervention (n=23)
Other mindfulness approaches e.g., mindful yoga or eating (n=19)
No control groups (n=16)
Adolescents/children (n=14)
Means and standard deviations not provided or unclear (n=13)
Mixed Type 1 and Type 2 Diabetic population (n=11)
CBT vs control (n=10)
Unclear use of measures (n=9)
LTC does not require dietary management (n=6)
Outcome measure of adherence (n=4)
Number of participants missing (n=1)
Articles included: (n=34)

Table 3 alphabetically presents the studies remaining after applying the inclusion criteria and presents an overall summary of key information such as, sample sizes, type of therapeutic intervention provided, and outcome measures. It is important to note that some studies may have been included more than once if more than one outcome (e.g., anxiety and depression) were reported.

**Table 3**

*Summary Of Studies*

| Author & Year | Total Sample Size | Treatment Group N | Control Group N | Design | Third-Wave Intervention | Diagnosis | Outcomes | Facilitator & Training | Intervention Duration And Frequency | Control Group Intervention | Outcome Measures | Country |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aarab (2017) | 34 | 17 | 17 | RCT | ACT | Type 2 Diabetes | Depression & Anxiety | Not specified | 8 x 60-minute weekly sessions | TAU | Emotions control scale & Thoughts Control Questionnaire – Anxiety and Depression subscales used | Iran |
| Afshar-Zanjani (2021) | 30 | 15 | 15 | RCT | CFT | IBS | Depression & QOL | Not specified | 4 x 90-minute weekly sessions | Routine IBS treatment | Beck Depression inventory & The QOL Scale | Iran |
| Alsubaie (2020) | 18 | 11 | 7 | RCT | MCBT & MBSR | Cardiovascular | Depression | Trained and experienced mindfulness-based therapist | 8 x 2.5hr weekly sessions. Max Group: 30 participants | TAU with Mental Health Nurse or Cardiac Nurse | GAD7, Cardiac Anxiety Questionnaire (CAQ) | UK |
| Asadollahi (2014) | 24 | 12 | 12 | RCT | MCBT | IBS | Anxiety & Depression | Not specified | 8 x 90-minute weekly sessions | Not specified | Symptom Checklist 90-R (SCL-90-R) | Iran |

| Author & Year | Total Sample Size | Treatment Group N | Control Group N | Design | Third-Wave Intervention | Diagnosis | Outcomes | Facilitator & Training | Intervention Duration And Frequency | Control Group Intervention | Outcome Measures | Country |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bronsi (2020) | 30 | 15 | 15 | RCT | CFT | Cardiovascular | Anxiety | Not specified | 8 x 120-minute weekly group sessions | No intervention | Anxiety Sensitivity Index (ASI) | Iran |
| Chen (2020) A | 128 | 62 | 66 | RCT | MBSR | Type 2 Diabetes | Depression | Registered Nurse trained in mindfulness | 9 x 90-minute sessions.<br><br>Groups of 8-10 participants | TAU | Chinese version of DASS - Depression and Anxiety Stress Scale | Taiwan |
| Chen (2021) B | 94 | 47 | 47 | RCT | MBSR | Type 2 Diabetes | Anxiety | Not specified | 8-week long session | Psycho-education | The Hamilton Anxiety Scale (HAMA-14), the Hamilton Depression Scale (HAMD-17) | China |
| Dowd (2022) | 60 | 29 | 31 | RCT | CFT | Coeliac Disease | Depression & Anxiety | Online intervention | 4-week POWER-C pilot program consisting of 4 x 20-minute modules | No intervention | State-Trait Anxiety Inventory | Canada |
| Fathi (2016) | 40 | 20 | 20 | RCT | ACT | Type 2 diabetes | Depression | Not specified | 8 x 90-minute sessions | No intervention | Beck Depression inventory | Iran |

| Author & Year | Total Sample Size | Treatment Group N | Control Group N | Design | Third-Wave Intervention | Diagnosis | Outcomes | Facilitator & Training | Intervention Duration And Frequency | Control Group Intervention | Outcome Measures | Country |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fayazbakhsh | 24 | 12 | 12 | RCT | ACT | Type 2 Diabetes | Anxiety | Not specified | 8 x 90-minute sessions | No intervention | GAD 7-item scale, Penn State Worry Questionnaire | Iran |
| Gaylord (2012) | 75 | 36 | 39 | RCT | MBSR | IBS | QoL | Clinical social worker or Trained master's students. | 8 weekly and one half-day intensive group sessions | Social-support group led by master's level social workers | IBS-QOL | USA |
| Ghahnaviyeh (2020) | 60 | 30 | 30 | RCT | ACT | Cardiovascular | QoL | Not specified | 8 x 90-minute weekly sessions of group therapy | No intervention | Minnesota living with heart failure (MLHFQ) | Iran |
| Ghandi (2018) | 16 | 8 | 8 | RCT | MBSR | IBS | QoL | Psychotherapist | 8 x 90-minute sessions of MBSR group therapy | Medication only | QoL in people with IBS (IBS- QOL) | Iran |
| Gotnik (2017) | 410 | 205 | 205 | RCT | MBSR | Cardiovascular | Anxiety, Depression, QoL | Online intervention | 12-week structured online program | TAU with a cardiologist | Hospital Anxiety and Depression scale (DASS) | Netherlands |

| Author & Year | Total Sample Size | Treatment Group N | Control Group N | Design | Third-Wave Intervention | Diagnosis | Outcomes | Facilitator & Training | Intervention Duration And Frequency | Control Group Intervention | Outcome Measures | Country |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Guo (2022) | 100 | 50 | 50 | RCT | MBSR | Type 2 diabetes | Depression | Nurse-led MBSR therapy | 8 x 120-minute daily in-person group sessions, then 8-week technology-based maintenance practice component using WeChat | Psychoeducation | Diabetes distress scale (Chinese version) | China |
| Hartmann (2012) | 110 | 53 | 57 | RCT | MBSR | Type 2 Diabetes | Depression | Psychologist | 8 x weekly sessions in groups of 6–10 and a booster session after 6 months. | Regular healthcare meetings | Patient Health Questionnaire (PHQ) | Germany |
| Ito (2020) | 26 | 14 | 12 | RCT | ACT | IBS | QoL, Depression, Anxiety | No facilitator and self-help programme | 1-day group workshop and a 2-month self-help programme | No intervention | IB QOL (Japanese version, BDI-I (Beck Depression Inventory, State trait Anxiety Inventory) | Japan |
| Jalali (2019) | 60 | 30 | 30 | RCT | MBSR | Cardiovascular | QoL | Psychologist | 8 sessions | TAU | 36-item Short Form Survey (SF-36) | Iran |

| Author & Year | Total Sample Size | Treatment Group N | Control Group N | Design | Third-Wave Intervention | Diagnosis | Outcomes | Facilitator & Training | Intervention Duration And Frequency | Control Group Intervention | Outcome Measures | Country |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kaveh (2022) | 30 | 15 | 15 | Non-randomised | CFT | IBS | Depression & Anxiety | | 8 x 90-minute training sessions | Medication | Depression and anxiety stress scale DASS | Iran |
| Kian (2018) | 59 | 29 | 30 | RCT | MBSR | Type 2 Diabetes | Anxiety, Depression | Supervised by a certified instructor, with 3-yr minimum experience | 8 sessions | TAU | Hamilton Depression Rating Scale (HDRS), and Hamilton Anxiety Rating Scale (HARS) | Iran |
| Maghsoudi (2019) | 80 | 40 | 40 | RCT | ACT | Type 2 Diabetes | Depression | Clinical psychologist and nurse | 8 x 90-minute weekly group sessions | TAU | Diabetes Distress Scale | Iran |
| Mirsharifa (2019) | 30 | 15 | 15 | RCT | ACT | IBS | Depression | Not specified | 6 x 90-minute sessions | No intervention | Beck Depression Inventory | Iran |
| Mohamadi J (2019) | 36 | 16 | 20 | RCT | DBT & MCBT | IBS | QoL | MBCT: Psychologist, with 3+ yrs experience DBT: Coach, with 3+ yrs training | DBT: 8 x 120-minutes weekly group sessions<br>MBCT: 8 x 120-minute weekly group sessions | No intervention | IBS-QOL, perceived stress scale | Iran |

| Author & Year | Total Sample Size | Treatment Group N | Control Group N | Design | Third-Wave Intervention | Diagnosis | Outcomes | Facilitator & Training | Intervention Duration And Frequency | Control Group Intervention | Outcome Measures | Country |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mohamadi KA (2019) | 30 | 15 | 15 | Non-randomised | ACT | Cardiovascular | QoL | Trained psychology PhD students | 8 sessions | No intervention | WHO QoL questionnaire (1996) | Iran |
| Nijjar | 47 | 31 | 16 | RCT | MBSR | Cardiovascular | Depression, Anxiety & QOL | Trained instructor | 8-week group interventions | TAU | PHQ9, HRQOL | USA |
| Parswani (2013) | 30 | 15 | 15 | RCT | MBSR | Cardiovascular | Anxiety & Depression | At home, via cassettes | 8 x 90-minute weekly sessions | TAU after psychoeducation | Hospital Anxiety and Depression Scale, Perceived Stress Scale (perceived stress) | India |
| Pearson (2018) | 67 | 31 | 36 | RCT | MBSR | Type 2 Diabetes | Anxiety & Depression | Audio CD of guided mindfulness | 8 weeks of 30-minute self-guided per day | TAU | Depression, Anxiety and Stress Scale | Australia |
| Rafieian (2022) | 40 | 20 | 20 | RCT | CFT & DBT | Cardiovascular | Anxiety | Psychologist, with 3+yrs | CFT: 12 sessions weekly over 3 months<br><br>DBT: 12 sessions weekly over 3 months | TAU | STAI-Y State-Trait Anxiety Scale: | Iran |

| Author & Year | Total Sample Size | Treatment Group N | Control Group N | Design | Third-Wave Intervention | Diagnosis | Outcomes | Facilitator & Training | Intervention Duration And Frequency | Control Group Intervention | Outcome Measures | Country |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rahimi (2019) | 25 | 12 | 13 | RCT | ACT | Type 2 Diabetes | QoL | Psychologist, with 3+yrs | 10 x 120-minute sessions | TAU | Diabetic Patients QoL Questionnaire (DQOL) | Iran |
| Sehati (2019) | 30 | 15 | 15 | RCT | DBT | IBS | QoL | No mentioned | 10 x 90-minutes group sessions for 2.5 months with 5 members | No intervention | Anxiety sensitivity index questionnaire | Iran |
| Younge (2015) | 324 | 215 | 109 | RCT | MCBT | Cardiovascular | Anxiety & Depression | Online training | 12 weeks, self-directed online programme | TAU by cardiologist | HADS, Perceived stress scale | Netherlands |
| Zadeh (2022) | 24 | 12 | 12 | RCT | ACT | Cardiovascular | Depression | Not mentioned | 8 x 120-minute weekly sessions | No intervention | Beck Depression Inventory | Iran |
| Zare (2014) | 28 | 14 | 14 | RCT | MCBT | Type 2 Diabetes | QoL | Not mentioned | 8 x 60-minute group sessions | Not mentioned | Diabetes and diabetes-dependent QoL questionnaire | Iran |

| Author & Year | Total Sample Size | Treatment Group N | Control Group N | Design | Third-Wave Intervention | Diagnosis | Outcomes | Facilitator & Training | Intervention Duration And Frequency | Control Group Intervention | Outcome Measures | Country |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zernicke (2011) | 90 | 43 | 47 | RCT | MCBT | IBS | QoL | Registered nurse | 8 x 90min weekly group sessions & 3hr workshop retreat between session 6 and 7. | TAU | The IBS-QOL | Canada |

**Data Processing**

All data for the meta-analysis were extracted by the author. Treatment outcomes in the form of means, standard deviations, and sample-size for each of the treatment and control groups were extracted separately and the standardised mean differences were calculated. If standard deviations for each group were not reported individually, then the pooled standard deviation was calculated (Borenstein et al, 2009; Cohen, 1988). For two papers, standardised mean differences were calculated from t or F statistics (Mohamadi, 2019; Maghsoudi et al, 2019) .

It should be noted that effects sizes as reported in primary studies are frequently calculated from data which has been adjusted for the association with one or more covariates. Such adjustments emphasise the idiosyncratic character of the reported effect and may result in dissimilarity with the effects reported within the other primary studies. The contribution of adjusted effect size to overall heterogeneity was examined empirically if problematic heterogeneity is identified in the random effects model.

Multiple reporting of outcomes can result from primary studies reporting multiple measures of the same outcome or reporting the same outcome measure in multiple subgroups. Where possible, multiple outcomes were combined in a single quantitative outcome using the procedures described by Borenstein et al, (2009). If it was not possible to combine the multiple effects into a single quantitative effect, then the multiple effects have been included in the meta-analysis. The inclusion of multiple reporting of outcomes from that same primary study may result in a slight reduction in confidence intervals for the random effects model as the sample size of that primary study will be included twice. Therefore, there were 34 studies reporting 88 effects from separate data for anxiety, depression, and QoL.

### *Defining problematic variance*

A study level effect is considered heterogeneous if it presents with variation from the meta-analysis synthesis that cannot be attributed to true variation in the distribution of effect in the population. Heterogeneity can result from methodological variation in the studies, measurement error or uncontrolled individual difference factors within the body of literature. Higgins $I^2$ is a commonly used well-established measure of heterogeneity (Higgins et al, 2003), with greater values of $I^2$ indicating variation in effect that cannot be attributed to true variation in the distribution of effect in the population. Due to the considerable variation in methodologies of the selected studies, problematic heterogeneity was defined as a Higgins $I^2$ value greater than 75%.

### *Risk of Bias Assessment and Quality Index*

A set of risk of bias criteria were developed to assess study level risk of bias within this literature. The risk of bias criteria was adapted from The Cochrane Collaboration Risk of Bias Tool (Higgins et al, 2011). The current framework assesses risk of bias in seven domains: selection bias, performance bias, treatment fidelity, detection bias, statistical bias, reporting bias, and generalisability. The risk of bias in the seven domains and the criteria for Low, Unclear or High risk is described in

Table 4 and the application of these criteria are reported in Table 5, alongside the overall quality index percentage for each study.

**Table 4**

*Domains Of Risk Of Bias And The Criteria For Ratings Of Low, Unclear Or High Risk*

| Risk Domain | Details | Rating | Risk of Bias |
|---|---|---|---|
| Selection Bias | *Explanation:*<br>Bias can emerge in the selection period of research through unrepresentative or idiosyncratic sampling or through assigning participants to an intervention or control group without randomisation.<br><br>*Consideration points:*<br>Was random sequence generation present?<br>Was randomisation entirely random, pseudo-randomised or not randomised?<br>Were participant characteristics reported?<br>Were participants representative of the population being assessed?<br>Was the randomisation procedure reported and clearly described? | High risk | Participants are not randomised to groups. Participant characteristics are not reported or are highly idiosyncratic. |
| | | Unclear risk | Participants are pseudo-randomised. Randomisation procedure is not reported. Participant characteristics are reported but are idiosyncratic. |
| | | Low risk | Participants are randomised to groups. Randomisation is reported. Participant characteristics are reported and representative of the target population. |
| Performance Bias | *Explanation:*<br>Participants and/or facilitators awareness of experimental allocation may bias the findings. 'Blinding' participants/facilitators to the experimental allocation can help to control for this.<br><br>*Consideration points:* Were participants and facilitators blinded? | High risk | Blinding is absent or not reported. |
| | | Unclear risk | Either participants or facilitators are not blinded. |
| | | Low risk | Participants & facilitators are blinded to the experimental allocation. |
| Treatment Fidelity | *Explanation:*<br>Poor treatment fidelity assures that the study is conducted consistently and reliably, affecting generalisability of findings.<br><br>*Consideration points:*<br>Is the content and procedure of the intervention reported?<br>Has the training of facilitators been described?<br>Were facilitators appropriately trained in the third wave intervention? | High risk | Group procedures and intervention methods may be reported. Professionals facilitating group are not reported or their training is not reported/inappropriate. |
| | | Unclear risk | Group procedures and intervention methods are reported. Training of facilitators is not reported. |
| | | Low risk | Group procedures and intervention methods are reported. Treatment fidelity is assessed and reported. Group facilitators are trained in the intervention. |

| Risk Domain | Details | Rating | Risk of Bias |
|---|---|---|---|
| Detection Bias | *Explanation:*<br>Detection bias looks at the differences between groups in determining outcomes.<br><br>*Consideration points:*<br>How were outcomes measures?<br>Were researchers blinded?<br>Was the study a randomised controlled trial? | High risk | Researchers are not blinded, or blinding is not reported. The study design was cohort analytic or weaker. |
| | | Unclear risk | Blinding is not reported or unclear. The study design is controlled clinical trial. |
| | | Low risk | These individuals are blinded to the experimental condition. The study design is randomised controlled trial. |
| Statistical Bias | *Explanation:*<br>Appropriate analyses selected to analyse data and to manage impact of attrition. Intention-to-treat (ITT) analysis is used.<br><5% attrition good<br>5-19% average<br>20%> risk of bias<br><br>*Consideration points:*<br>Have attrition rates been mentioned and described adequately? | High risk | High attrition and only completer analyses reported. Or Low attrition and only completer analysis reported. |
| | | Unclear risk | Low attrition with completer or ITT analyses reported, non-completers described |
| | | Low risk | No or very low attrition and appropriate analyses selected. |
| Reporting Bias | *Explanation:*<br>Selective reporting of findings can lead to bias favouring the experimental condition. Good quality studies should report all findings reported in the study's method.<br><br>*Consideration points:*<br>Were all aims of the study mentioned in the results?<br>Were descriptive statistics provided? | High risk | Not all descriptive and/or summary statistics are presented. Only significant findings are reported. |
| | | Unclear risk | Not all descriptive and/or summary statistics are presented. |
| | | Low risk | All results explained in method are reported. |
| Generalisability | *Explanation:*<br>The generalisability of the study refers to how confident we can be that the results of the research are applicable to the wider population they are meant to represent.<br><br>*Consideration points:*<br>What was the sample size for the population?<br>Were participants representative of the long-term health condition they are diagnosed with? | High risk | Sample is n<20. Participants are sampled from an unrepresentative population or not reported. |
| | | Unclear risk | Sample is n>20 but may have some idiosyncratic features. |
| | | Low risk | Sample is n>20 with no idiosyncratic features. |

### *Selection Bias*

Selection Bias refers to the way in which participants are selected and recruited for studies. From the thirty-four studies reviewed, twenty-three studies were rated as having unclear risk of selection bias, ten were rated as low risk of bias and one study (Kaveh et al, 2022) was rated as having a high risk of bias (Table 6). The studies rated as low risk had clearly described the randomisation processes using specific methods of randomisation, for example 'sequential sequencing' (Ghahnaviyeh et al, 2020) or randomisation using computer software programmes (Ito & Muto, 2020), therefore reducing the risk of bias. Studies marked as unclear risk used randomisation, however the procedure for doing so was not clearly described (Ghandi et al, 2018) and studies scoring as high risk did not mention the process of randomisation used.

### *Performance Bias*

Performance Bias refers to the bias that may arise due to differences in methodology between studies. Performance bias was mostly rated as high risk, with twenty studies scoring at this level. This was due to participants not being blinded to the treatment condition that they were placed in (Asadollahi et al, 2014; Maghsoudi et al, 2019). There were seven studies rated as unclear risk due to unclear reporting of the blinding of participant in conditions. Seven studies were rated as low risk as participants were not aware of the treatment condition they were placed in (Younge et al, 2015).

### *Treatment Fidelity*

Treatment Fidelity refers to the extent and consistency of which an intervention is delivered as intended. The fifteen papers that scored high in treatment fidelity bias was due to intervention procedures and methodology being unclearly described, facilitator details and experience were also not provided (Hartmann et al, 2012; Parswani et al, 2013). Eleven studies

scored low in bias as these studies adequately reported study procedures, intervention methods and outlined the details and training of facilitators. The eight studies scoring unclear in bias often reported intervention procedures (Maghsoudi et al, 2019) however did not provide intervention facilitator details or vice versa (Guo et al, 2022).

### *Detection Bias*

Detection bias refers to the differences in how outcomes are measured. Twelve studies scored high in risk of detection bias as researchers were not blinded to treatment outcomes (Asadollahi et al, 2014). Eleven studies scored unclear in bias as the blinding of researchers was unclearly reported (Sehati et al, 2019). There were eleven studies scoring low in bias as these studies involved blinding of researchers to the treatment conditions and often used external researchers from the study for analysis (Ito & Muto, 2020).

### *Statistical Bias*

Statistical bias refers to the various aspects leading to systematic differences between the true factors of a population and the statistics used to estimate those factors. Eighteen studies were assessed to be high in statistical risk of bias, largely due to attrition rates not being mentioned (Afshar-Zanjani et al, 2021; Ghahnaviyeh et al, 2020) or having low attrition rates (Rahimi et al, 2019). Ten studies were assessed as being unclear risk, often due to low attrition and completer-only analysis being mentioned (Zernicke et al, 2011). The six studies that scored low in risk of bias had low attrition rates and all relevant statistics were mentioned.

### *Reporting Bias*

Reporting bias can refer to the selective reporting in studies. Overall, the reporting bias of the studies was considered to be good, as twenty-three studies were classed as low risk of

reporting bias since all aims and statistics were clearly reported. Five papers were found to be of unclear risk because limited descriptive statistics were provided (Bronsi et al, 2020). Due to unclear reporting or elimination of statistics and results, six studies were determined to be high in risk of bias (Mirsharifa et al, 2019).

### *Generalisability*

Generalisability bias refers to the potential degree a study's findings can be applied to a broader population. The small sample sizes in seventeen studies contributed to high risk for generalisability. Eight studies were assessed to be unclear in risk due to specific population factors, for example, an elderly population sample (Maghsoudi et al, 2019), university students (Ito & Muto, 2020) or a research clinic in Iran. Nine studies were classed as low risk as sample sizes appeared to be representative and generalisable.

### *Summary*

Overall, there was a mixed level of bias across the studies included in the meta-analysis. There was one included study (Gotink et al., 2017) that scored low risk in all of the risk of bias categories. There was a notable high risk of bias across studies in generalisability and adherence to treatment fidelity. Detection bias was ambiguous across studies. Due to the low number of studies meeting the inclusion criteria, studies with medium to high risk of bias were included, and consequently, the results of this meta-analysis should be interpreted with caution. However, the studies included are felt to be a representative summary of the research literature as it stands currently, and it is hoped that future research will include higher quality research with larger sample sizes, which addresses many of the risks of bias inherent in the current literature.

**Study Design Hierarchy**

In addition to risk of bias, a study design hierarchy was calculated to reflect the impact of the variations in study design, refer to Table 5.

**Table 5**

*Study Design Hierarchy*

| Study Design | Quality Score | Description |
|---|---|---|
| **Randomised controlled trial/experiment** | 25 | These are experimental studies comparing groups (usually two) to establish the effectiveness of specific interventions The most common design is to compare a new intervention against normal practice (treatment as usual). Participants in the trials are randomly assigned to the treatment groups to minimise bias. |
| **Non-randomised controlled trial/experiment** | 15 | These trials are run when it is not possible to incorporate randomisation into the design. There is an increased risk of biases being introduced into the research and this should be considered carefully when analysis is reported. |

Each study was awarded an overall quality index score which was calculated by the addition of the risk of bias ratings for each of the seven areas of risk of bias (two points for low risk, one point for unclear risk and zero points for high risk of bias) with the quality score for the basic study design. The overall quality index was then expressed as a percentage of the maximum possible score (Table 6).

**Table 6**

*Risk Of Bias*

| Study | Selection Bias | Performance Bias | Treatment Fidelity | Detection Bias | Statistical Bias | Reporting Bias | Generalisability | Overall Quality Index |
|---|---|---|---|---|---|---|---|---|
| Aarab (2017) Type 2 Diabetes | Unclear risk | High risk | High risk | High risk | High risk | High risk | High risk | 67% |
| Afshar-Zanjani (2021) IBS | Unclear risk | High risk | High risk | High risk | High risk | Low risk | High risk | 72% |
| Alsubaie (2020) Cardiovascular | Low risk | Unclear risk | Low risk | Low risk | Low risk | Low risk | Low risk | 97% |
| Asadollahi (2014) IBS | Unclear risk | High risk | High risk | High risk | High risk | Unclear risk | High risk | 69% |
| Bronsi (2020) Cardiovascular | Unclear risk | High risk | High risk | High risk | High risk | Unclear risk | High risk | 69% |
| Chen (2019) Type 2 Diabetes | Unclear risk | Unclear risk | Low risk | Low risk | Low risk | Low risk | Low risk | 95% |
| Chen (2021) Type 2 Diabetes | Unclear risk | High risk | High risk | High risk | High risk | Unclear risk | High risk | 64% |
| Dowd (2022) Coeliac Disease | Unclear risk | High risk | Low risk | Unclear risk | Unclear risk | Low risk | Unclear risk | 85% |
| Fathi (2016 Type 2 Diabetes | Unclear risk | High risk | High risk | Unclear risk | Unclear risk | Low risk | Low risk | 82% |
| Fayazbakhsh 2019 Type 2 Diabetes | Unclear risk | High risk | High risk | High risk | High risk | High risk | High risk | 67% |
| Gaylord (2011) IBS | Low risk | Low risk | Low risk | Low risk | Unclear risk | Low risk | Low risk | 97% |
| Ghahnaviyeh (2020) Cardiovascular | Low risk | High risk | High risk | Low risk | High risk | Low risk | High risk | 79% |
| Ghandi (2018) IBS | Unclear risk | Unclear risk | Low risk | Low risk | High risk | Low risk | High risk | 85% |
| Gotink (2017) Cardiovascular | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk | 100% |
| Guo (2021) Type 2 Diabetes | Low risk | Unclear risk | Unclear risk | Low risk | Low risk | Low risk | Unclear risk | 92% |
| Hartmann (2012) Type 2 Diabetes | Unclear risk | Unclear risk | High risk | High risk | High risk | Unclear risk | Unclear risk | 74% |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Ito (2020) IBS | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk | Unclear risk | 97% |
| Jalali (2019) Cardiovascular | Unclear risk | Low risk | Low risk | Low risk | Unclear risk | Low risk | Unclear risk | 92% |
| Kaveh (2022) IBS | High risk | High risk | Unclear risk | High risk | High risk | Low risk | High risk | 46% |
| Kian (2018) Type 2 Diabetes | Unclear risk | High risk | High risk | Unclear risk | Unclear risk | Low risk | Unclear risk | 79% |
| Maghsoudi (2019) Type 2 Diabetes | Low risk | High risk | Unclear risk | Unclear risk | High risk | Low risk | Unclear risk | 82% |
| Mirsharifa (2019) IBS | Unclear risk | High risk | High risk | High risk | High risk | High risk | High risk | 67% |
| Mohamadi J (2019) IBS | Unclear risk | Low risk | Low risk | Unclear risk | Low risk | Low risk | Unclear risk | 92% |
| Mohamadi KA (2019) Cardiovascular | Low risk | High risk | Low risk | High risk | Unclear risk | Unclear risk | High risk | 54% |
| Nijjar (2019) Cardiovascular | Unclear risk | High risk | High risk | Unclear risk | Unclear risk | Low risk | High risk | 77% |
| Parswani (2013) Cardiovascular | Unclear risk | Unclear risk | High risk | Unclear risk | High risk | Low risk | High risk | 77% |
| Pearson (2018) Type 2 Diabetes | Low risk | Low risk | Low risk | Low risk | High risk | Low risk | Low risk | 95% |
| Rafieian (2022) Cardiovascular | Unclear risk | High risk | Unclear risk | Unclear risk | Unclear risk | Low risk | Low risk | 85% |
| Rahimi (2019) Type 2 Diabetes | Unclear risk | High risk | Unclear risk | Unclear risk | High risk | Low risk | High risk | 77% |
| Sehati (2019) IBS | Unclear risk | High risk | Unclear risk | Unclear risk | High risk | High risk | High risk | 72% |
| Younge (2015) Cardiovascular | Low risk | Low risk | Unclear risk | Low risk | High risk | Low risk | Low risk | 92% |
| Zadeh (2022) Cardiovascular | Unclear risk | High risk | High risk | High risk | Unclear risk | High risk | High risk | 69% |
| Zare (2014) Type 2 Diabetes | Unclear risk | High risk | High risk | High risk | High risk | High risk | High risk | 67% |
| Zernicke (2012) IBS | Unclear risk | Unclear risk | Unclear risk | Unclear risk | Unclear risk | Low risk | Low risk | 87% |

# RESULTS

For this meta-analysis anxiety, depression and QoL outcomes were extracted. As there were studies that reported two or three of the outcomes being measured, for example anxiety and depression, both were extracted and analysed, therefore some studies will appear more than once in some analyses.

## Summary of Papers

A total of 34 studies reporting 88 outcomes from a total of 2294 participants were included in this meta-analysis. The smallest study sample size was 16 (Ghandi et al, 2018) and the largest was 410 (Gotink et al, 2017). Participants were recruited from the following eleven countries: Iran (N=20), Canada (N=2), China, (N=2), Netherlands (N=2), USA (N=2), Australia (N=1), Germany (N=1), India (N=1), Japan(N=1), Taiwan (N=1) and UK (N=1).

In terms of intervention characteristics, the lengths of intervention varied, however the majority consisted of eight intervention sessions in frequency (N=25), whether that be group or individual. The interventions delivered varied in the type of facilitator administering the intervention. For example, some studies had trained psychologists (Hartmann et al, 2012; Jalali et al, 2019), trained psychology students (Mohamadi et al, 2019), nurse-led (Guo et al, 2022; Zernicke et al, 2011) and others used online technology and were guided self-help based (Ito & Muto, 2020; Pearson et al, 2018). There were thirteen studies that did not provide facilitator details (Sehati et al, 2019; Zare et al, 2014). The type of intervention also varied from group-based workshops (Ghandi et al., 2018), individual therapy (Asadollahi et al, 2014; Chen et al, 2020) and also online app-based therapy (Dowd et al, 2022; Gotink et al, 2017).

Table 7 presents the five third-wave psychological interventions, four dietary managed chronic conditions and the three outcomes that met the inclusion criteria for the analysis.

**Table 7**

*Study Characteristics*

| Characteristic | Number of studies |
|---|---|
| ***Third-Wave Intervention*** | |
| ACT | 10 |
| CFT | 5 |
| DBT | 3 |
| MBSR | 13 |
| MCBT | 6 |
| ***Dietary-managed conditions*** | |
| Cardiovascular Disease | 11 |
| CD | 1 |
| IBS | 10 |
| T2D | 12 |
| ***Outcomes*** | |
| Depression | 18 |
| Anxiety | 17 |
| QoL | 13 |

***Some papers have been included twice as they reported more than one outcome or included more than one intervention.*

## Efficacy of Third-Wave Interventions for Depression in People With Dietary Managed Chronic Health Conditions

There were eighteen studies that reported treatment effects for depression in a total of 1308 participants. There were three papers where participants had Cardiovascular Disease, six papers reporting IBS, eight papers reporting Type 2 Diabetes and one paper reporting CD.

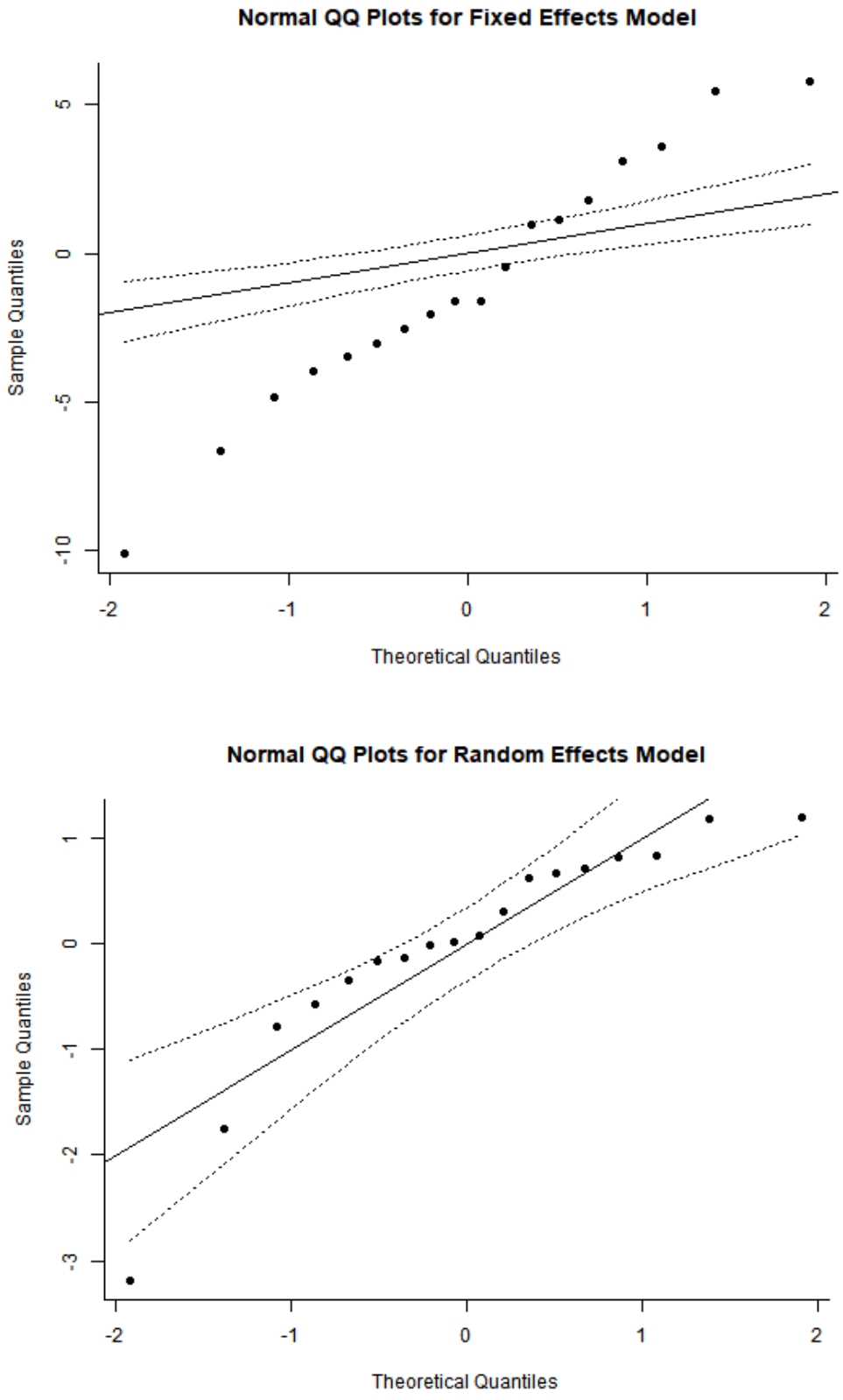
**Selection of the Meta-Analytic Model**

The distribution of primary study effects is shown in Figure 2. The between studies variance ($tau^2$) was calculated using the Restricted Maximum-Likelihood estimator. Due to the variations in interventions and methodologies The Random Effects Model was used throughout this review.

As observed in Figure 2, there is clear evidence of non-normality in the distribution of standardised mean differences in The Fixed Effects Model, which is largely absent when the random effects model is used. Therefore, this indicates the use of the Restricted Maximum Likelihood estimator is an appropriate method for the calculation of the weighted average treatment effect and between studies variance, as this estimator has been shown to be more robust to deviations from normality (Banks et al, 1985).

**Figure 2**

*QQ Plots for The Fixed Effects Models and Random Effects Model. The Random Effects Model meets assumptions of normality.*



**The Omnibus Test**

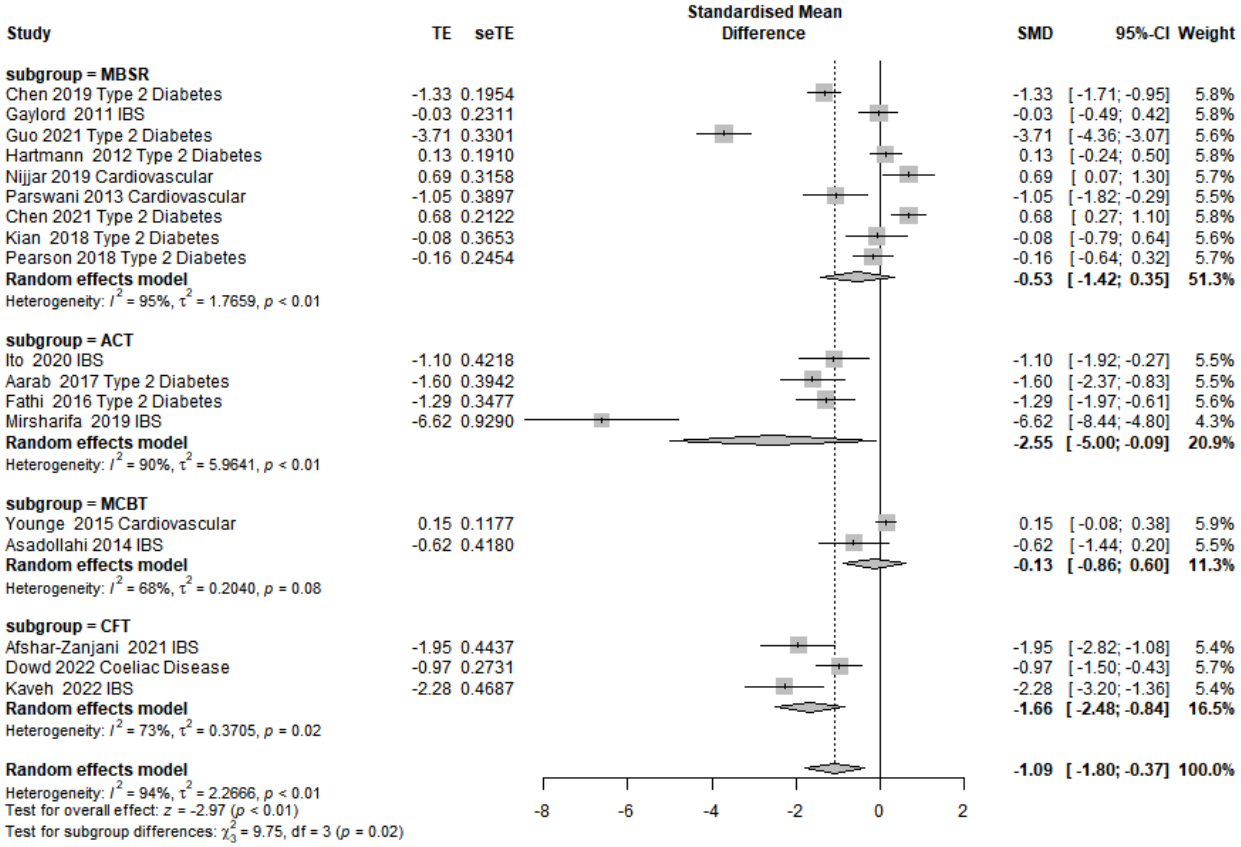
There are two methods of calculating the omnibus test: the fixed effects and random effects models (Hedges & Vevea, 1998). The fixed effects model is used when the intervention is expected to have the same effect across all participants and when all studies have used a uniformly excellent methodology (e.g., large samples). However, psychological research is usually conducted with a variety of methodologies in intervention and individual differences of participants. In these instances, the random effects model is the most appropriate method of calculating the omnibus test as it attempts to differentiate between the variables attributed to other factors.

A random effects models was calculated using the generic inverse variance method and the restricted maximum likelihood estimate of between studies variation ($tau^2$). The overall random effects model for third-wave psychological interventions with depression scores as an outcome suggested a statistically significant weighted average standardised mean difference of -1.09 and a 95% confidence interval of between -1.8 to -0.37. A treatment effect of this magnitude would be considered large (Hedges & Vevea, 1998.).

The treatment efficacy for the separate, individual, third-wave interventions for depression symptoms is shown in Figure 3, a negative standardised mean difference favours the intervention. A non-significant treatment effect favouring the treatment group was observed MBSR (SMD = -0.53, 95% CI [-1.42 to 0.35]) and MCBT (SMD = -0.13, 95% CI [-0.86 to 0.60]). Statistically significant treatment effects were observed for ACT (SMD= -2.55, 95% CI [-5.00 to -0.09]) and CFT (SMD = -1.66, 95% CI [-2.48 to -0.84]).

**Figure 3**

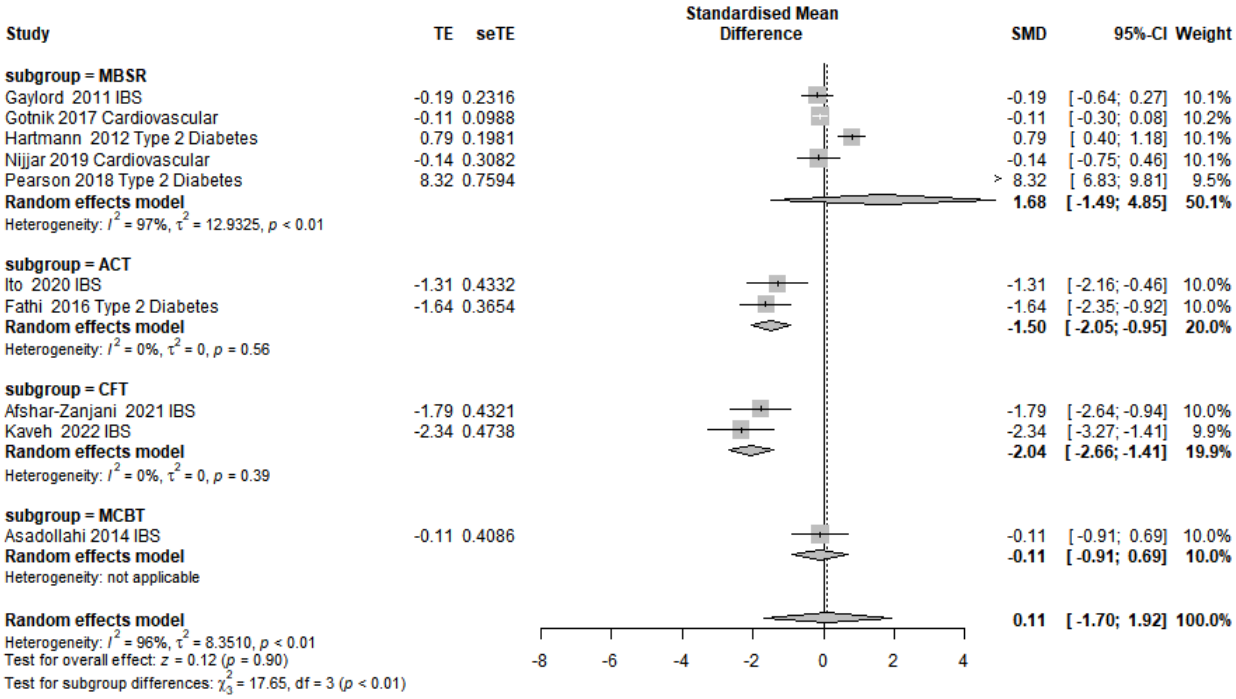
*Forest Plot depicting significant effects for ACT & CFT interventions in Depression Symptomatology at the End of Therapy*




There were ten papers that reported follow-up results. The treatment effects at follow-up are depicted in Figure 4. The significant end of therapy treatment effects for ACT (SMD = -1.50, 95% CI [-2.05 to -0.95]) and CFT (SMD = -2.04, 95% CI [-2.66 to -1.41]) were retained at follow-up. The follow-up time points in the ACT conditions were two-months (Ito & Muto, 2020) and three-months (Fathi et al, 2016), however the follow-up time points for the CFT interventions were not specified (Afshar-Zanjani et al, 202; Kaveh et al, 2022).

**Figure 4**

*Forest Plot depicting significant effects for ACT & CFT interventions on Depression Symptomatology at Follow-Up*




Heterogeneity refers to variation which cannot be attributed to true variation in participants' response to treatment. This heterogeneity can result from methodological variations, measurement error or uncontrolled variables in the literature.

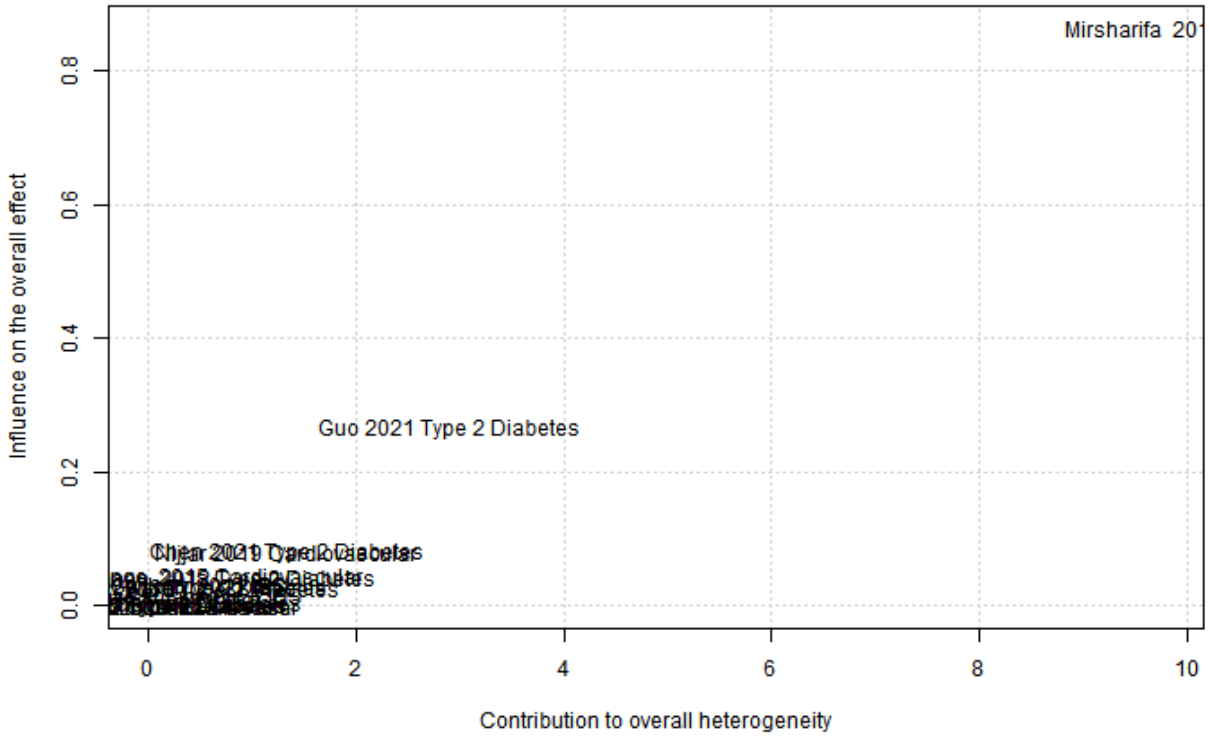
A high level of heterogeneity (Figure 3) was observed for all interventions: (MBSR $I^2$ = 95%, ACT $I^2$ = 90%, MCBT $I^2$=68%, and CFT $I^2$ = 73%), suggesting that the treatment effects reported in the included studies may be biased by the presence of uncontrolled or confounding factors. Therefore, the focus of the subsequent analyses will be upon the identification of the sources of heterogeneity between the estimates of treatment efficacy in the primary studies.

**The Impact of Influential Primary Studies**

The impact of disproportionately influence studies was assessed using a "leave-one-out" analysis, in which the random effects model was calculated with each of the primary studies removed in turn and change in weighted average effect size (i.e., influence) and the change in heterogeneity (i.e., discrepancy) was recorded. The result of this "leave-one-out" analysis is presented on the Baujat plot (Baujat et al, 2002) in Figure 5.

**Figure 5**

*Baujat Diagnostic Plot Of Sources Of Heterogeneity: Indicating Mirsharifa (2019) contributes to the overall heterogeneity.*




**Note: The vertical axis reports the influence of the study on the overall effect and the horizontal axis reports the discrepancy of the study with the rest of the literature.*

Figure 5 shows the study by Mirsharifa (2019) reports estimates of treatment efficacy that are both discrepant with the existent literature and influential upon the overall weighted average treatment effect. When compared to other studies Mirsharifa, (2019) had lower sample

sizes of fifteen participants in each condition and scored a fairly low-quality index score (67%). Overall, the study was of poorer quality in terms of reporting specific study details and methodology, for example, completer-only analysis was (n=25), despite reporting a sample size of (n=30). Consequently, given the extreme discrepancy and small sample, the paper was removed from further analysis.

**The Omnibus Test**

The random effects model was recalculated with Mirsharifa, (2019) removed. The corrected random effects model reported an overall synthesis for the effectiveness of third-wave interventions on depression scores (SMD = -0.8280 (95% CI [-1.3735 to -0.2825]). The corrected random effects model evidences a reduction of approximately 24% relative to the uncorrected estimate.

**The Effect of Risk Of Bias in the Included Studies**

To assess the impact of study level risk of bias upon heterogeneity, a series of subgroup analysis were conducted on the study level standardised mean differences for the risk of bias ratings of “low risk” and “any risk” (i.e., “any risk” includes unclear risk and high risk of bias combined) for each of the seven types of methodological bias.

**Table 8**

*Comparison of Standardised Mean Differences for Studies Rated as Low Risk or Any Risk of Bias*

| | Low Risk | | | Any Risk | | | | |
|---|---|---|---|---|---|---|---|---|
| | **EFFECT** | **95% CI** | **k** | **EFFECT** | **95% CI** | **k** | **X2** | **P** |
| Selection Bias | -0.0030 | -0.8028 to 0.7968 | 9 | -0.7895 | -1.2711 to -0.307 | 18 | 2.73 | 0.0987 |
| Performance Bias | 0.6140 | -0.2688 to 1.4968 | 6 | -0.8673 | -1.3569 to -0.3777 | 21 | 8.27 | **0.0040** |
| Treatment Fidelity | 0.0958 | -0.6355 to 0.8271 | 9 | -0.8634 | -1.4097 to -0.3172 | 18 | 4.24 | **0.0394** |
| Detection Bias | -0.1475 | -0.8920 to 0.5970 | 10 | -0.7551 | -1.2533 to -0.2568 | 17 | 1.77 | 0.1838 |
| Statistical Bias | -1.2706 | -2.2738 to -0.2674 | 6 | -0.3290 | -0.8012 to 0.1431 | 21 | 2.77 | 0.0960 |
| Reporting Bias | -0.6937 | -1.2084 to -0.1790 | 20 | -0.0608 | -0.5906 to 0.4691 | 7 | 2.82 | 0.0931 |
| Generalisability Bias | 0.1120 | -0.5399 to 0.7640 | 9 | -0.9046 | -1.4928 to -0.3163 | 18 | 5.15 | **0.0233** |

**Significant scores are highlighted in bold. P is significant at 0.05*

Table 8 presents each study's sensitivity to the six types of potential risk of bias. The significant differences in weighted average standardised mean differences are observed for performance bias, treatment fidelity and generalisability biases, visually depicted in Figure 6, Figure 7 & Figure 8. This suggests performance bias, treatment fidelity and generalisability biases are significantly impacting the overall conclusions of this meta-analysis and future studies should make effort to overcome these deficiencies in the existent literature.

**Figure 6**

*Subgroup Forest Plot depicting Performance Bias is significantly impacting results of the meta-analysis*

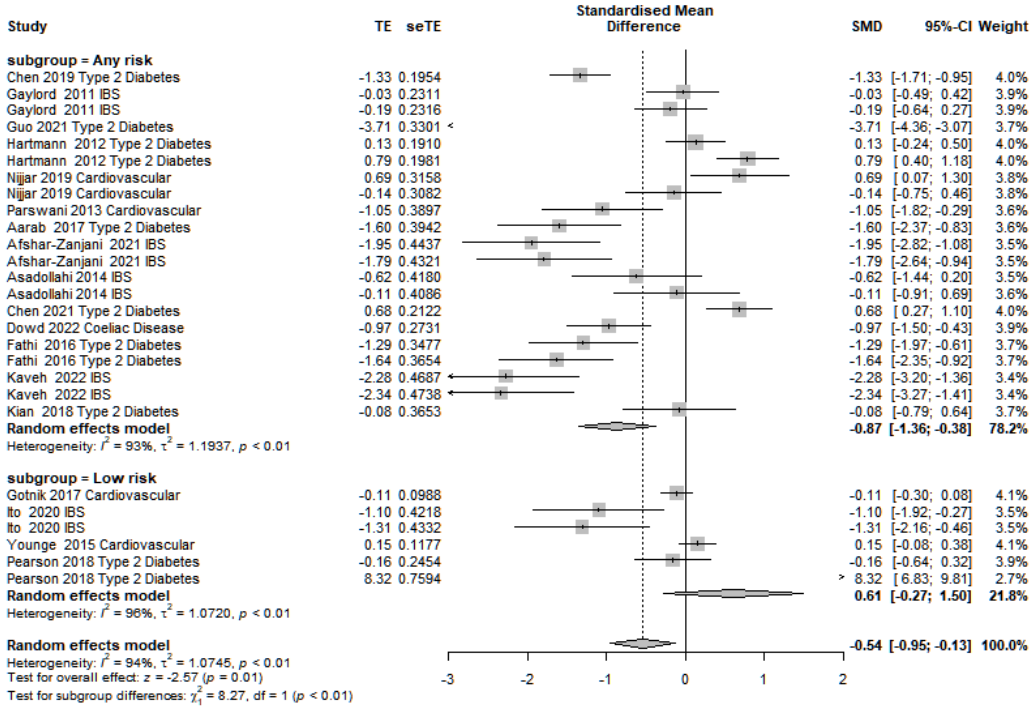



**Figure 7**

*Subgroup Forest Plot depicting Treatment Fidelity is significantly impacting results of the meta-analysis*

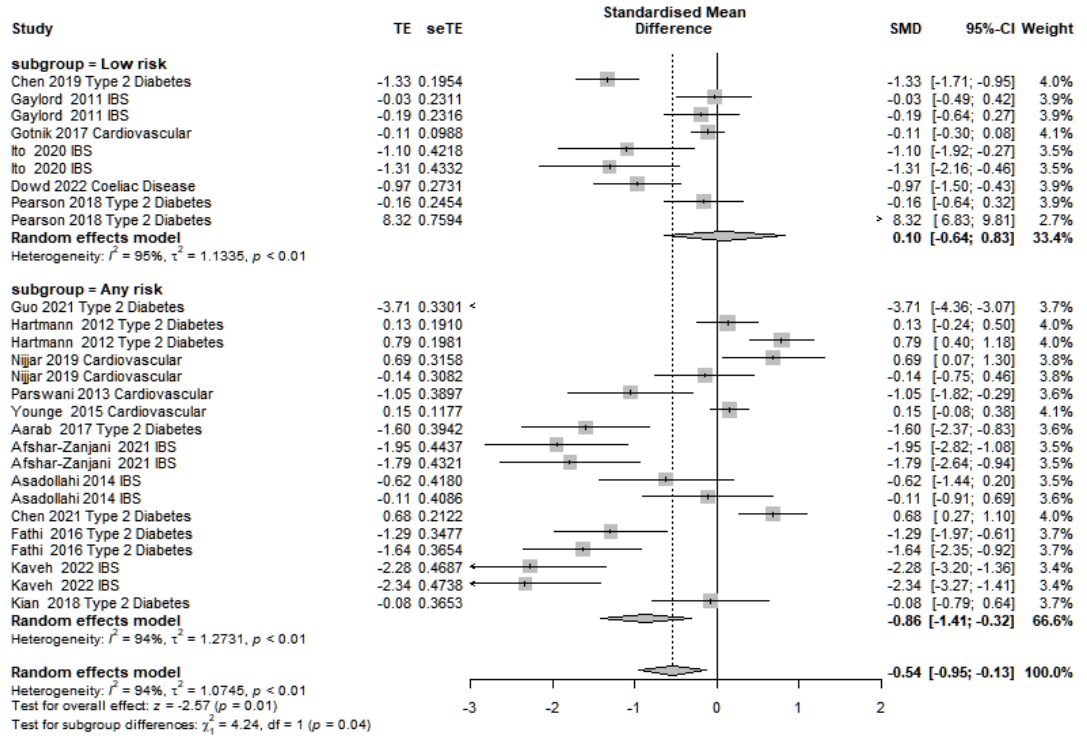
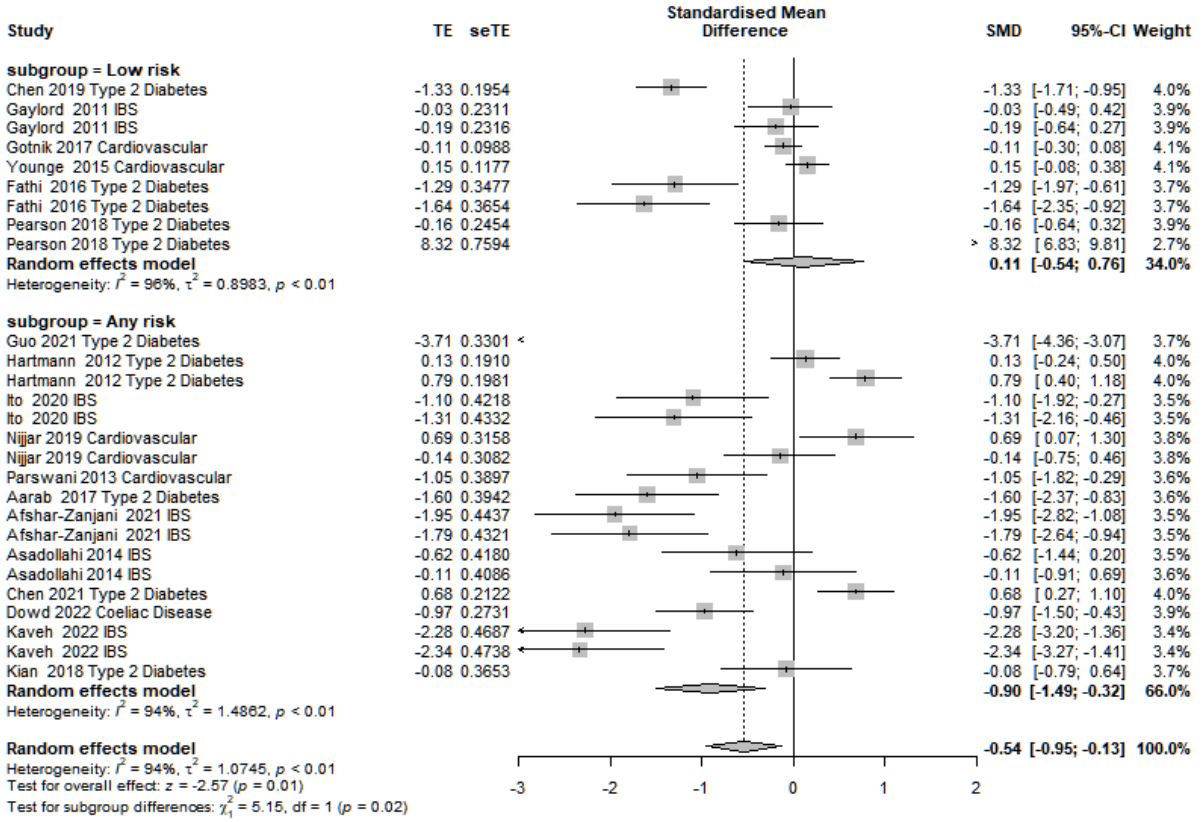


**Figure 8**

*Subgroup Forest Plot depicting Generalisability Bias is significantly impacting results of the meta-analysis*

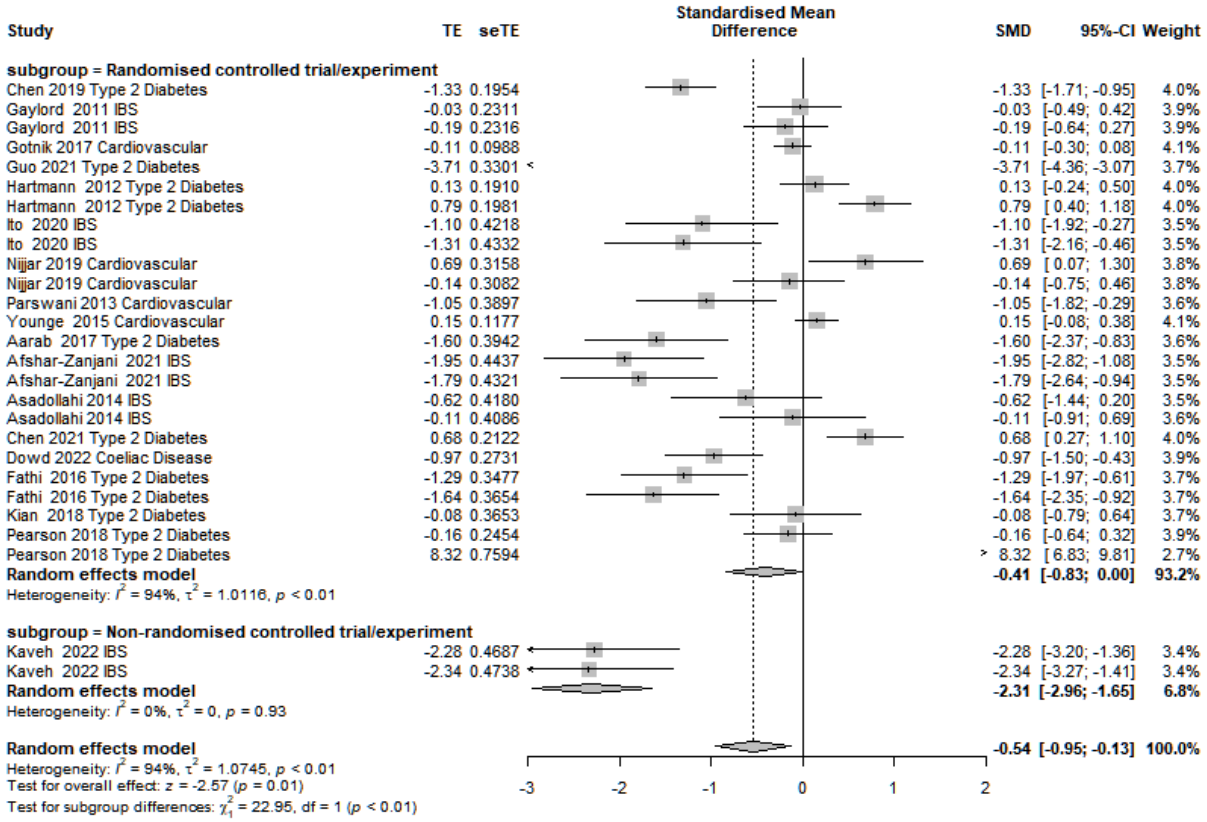



## The Effect of Study Level Design

A subgroup analysis was taken in order to assess the effect of depression on the weighted average standardised mean difference (Figure 9). As can be seen from the subgroup plot in Figure 9, there was a significant difference between randomized and non-randomised controlled studies ($I^2$ = 22.95, p<0.01), with the non-randomised controlled trials reporting approximately 4 times the effect size as randomized controlled studies. However, it should be noted that the non-randomised controlled studies estimate was derived from a single study (Kaveh et al, 2022) reporting two effect sizes, and therefore it is likely that this estimate will change upon the publication of future studies.

**Figure 9**

*Subgroup Forest Plot of the Study Level Design, depicting there is a difference between RCT's and Non-RCT's*



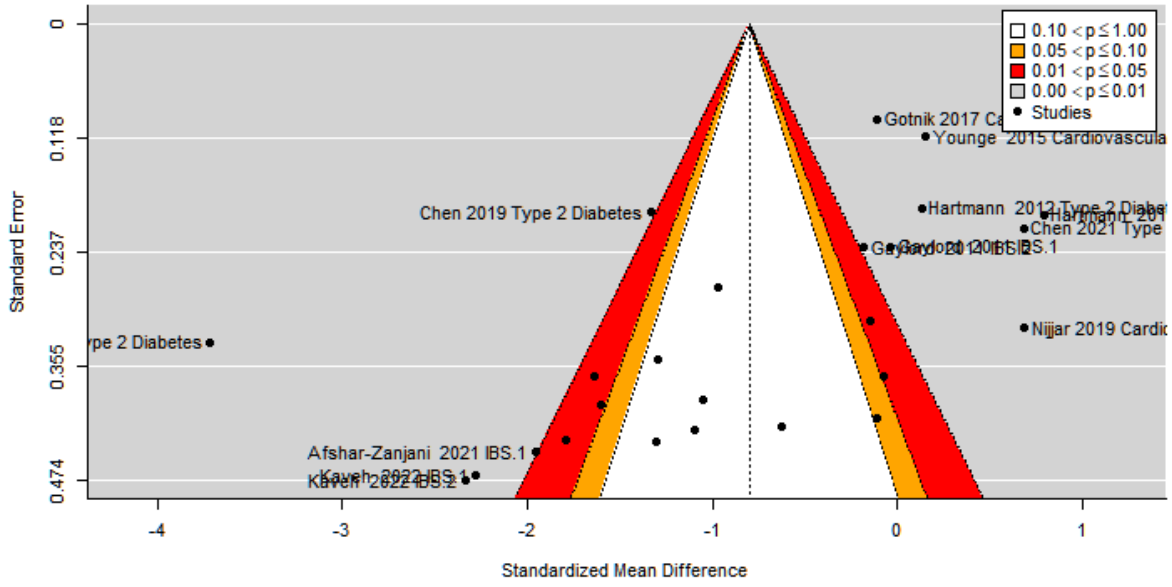

## The Impact of Publication and Small Study Biases

Publication bias is caused by the tendency for statistically significant results to be published and the reticence to publish papers with non-significant results. Small study bias is the tendency for studies with smaller sample sizes to show greater variability in their measurement of the treatment effect. These biases can be identified in a funnel plot, which plots the magnitude of a study's treatment effect. If there is an absence of publication bias, the effects from the studies with small sample sizes which show greater variability will scatter more widely at the bottom of the plot compared to studies with larger samples at the top, which will lie closer to the overall meta-analytic effect, creating a symmetrical funnel shape. If there is an absence of studies in the plot area associated with small sample sizes and non-significant

results, then it is likely there is some publication bias leading to an overestimation of the true effect. The funnel plot of the study level standardised mean differences plotted against study level standard error is presented in Figure 10.

**Figure 10**

*Contour Enhanced Funnel Plot of the Study Level Standardized Mean Differences Plotted Against Study Level Standard Error*




***Note: The 95% confidence interval of the expected distribution of treatment efficacy is shown as an inverted "funnel".*

As can be seen from Figure 10, there is clear evidence of the, previously noted, heterogeneity of the reported effect sizes (i.e., the large number of studies that are outside of the expected confidence interval for the weighted average standardised mean difference). However, there is no evidence of publication bias since there are a small number of studies in the area of the funnel plot which would be associated with null effects and publication bias. Therefore, no simulation of and adjustment for publication bias and small study effects was undertaken.

Rosenthal (1979) describes the calculation of a failsafe number; this method calculates the number of non-significant results needed in the meta-analysis for the overall effect to be non-significant ($p > 0.05$). This procedure suggests that 1041 studies would be required to reduce the observed SMD to non-significance, suggesting that the observed SMD is robust to studies missing due to publication bias.

**Results Summary**

There was a significant difference for ACT and CFT interventions for depression in people with dietary managed chronic health conditions and the treatment effects were maintained at follow up for both interventions. However, the impact of disproportionately influential studies was subsequently assessed as a high level of heterogeneity was observed, and it was found the study by Mirsharifa (2019) was influential on the overall weighted average treatment effect and was subsequently removed. A series of subgroup analysis were conducted to assess the impact of study level risk of bias upon heterogeneity, it was found that performance bias, treatment fidelity and generalizability biases significantly impacting the overall conclusions of this meta-analysis.

**Efficacy Of Third-Wave Interventions For Anxiety In People With Dietary Managed Chronic Health Conditions**

There were seventeen studies that reported anxiety outcomes in a total of 1389 participants. There were three papers investigating the effects of MCBT, seven papers into MBSR, four into ACT, four into CFT and two into DBT.

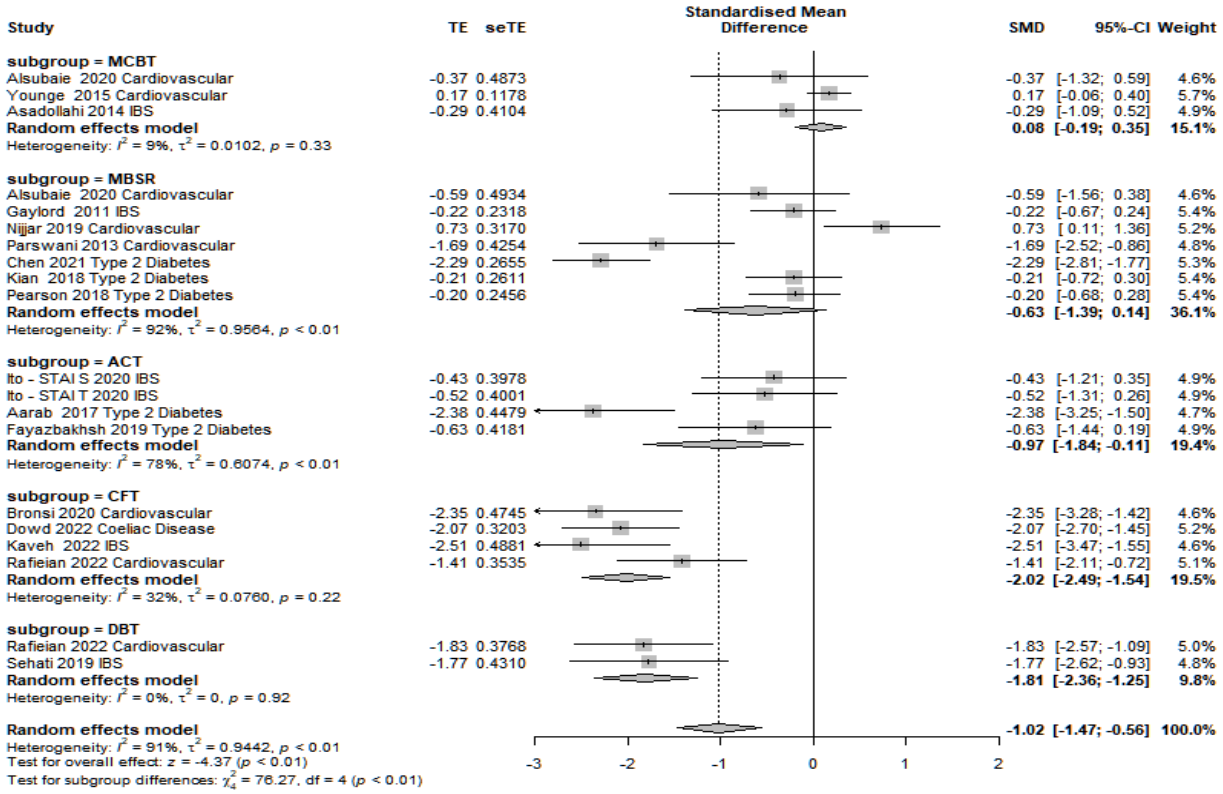
A random effects models was calculated using the generic inverse variance method and the restricted maximum likelihood estimate of between studies variation ($tau^2$). The overall

random effects model for third-wave psychological interventions suggested a weighted average standardised mean difference of -1.02 and a 95% confidence interval of between -1.47 to -0.56.

The treatment efficacy of the third-wave interventions for anxiety is shown in Figure 11. A non-significant treatment effect was observed for MCBT (SMD = 0.08, 95% CI [-0.19 to 0.35]) and MBSR (SMD = -0.63, 95% CI [-1.39 to 0.14]. A statistically significant treatment effect favouring the treatment group was observed for), ACT (SMD = -0.97, 95% CI [-1.84 to -0.11]) and CFT (SMD = -2.02, 95% CI [-2.49 to -1.54]) and DBT (SMD = -1.81, 95% CI [-2.36 to -1.25]).

**Figure 11**

*Forest Plot depicting significant effects for ACT, CFT & DBT interventions in Anxiety Symptomatology at the End of Therapy*



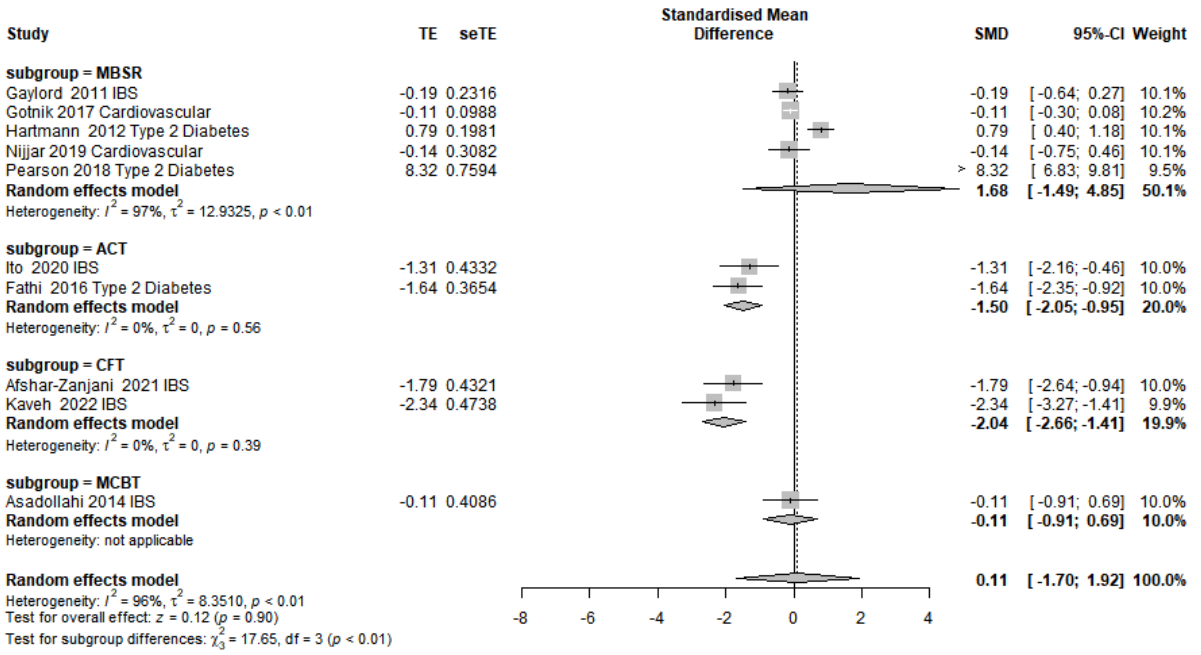

**A negative standardised mean difference favours the intervention.*

The treatment effects at follow-up are depicted in Figure 12. The significant end of therapy treatment effects for ACT (SMD= -1.50, 95% CI -2.05 to -0.95) were retained at a two-month follow-up (Ito & Muto, 2020) and for CFT (SMD = -2.04, 95% CI -2.66 to -1.41), however the follow-up time point was not reported (Kaveh et al, 2022).

A high level of heterogeneity (Figure 12) was observed for MBSR (MBSR $I^2 = 97\%$) only, suggesting that the treatment effects reported in the included studies may be biased by the presence of uncontrolled or confounding factors.

**Figure 12**

*Forest Plot depicting significant effects for ACT & CFT interventions in Anxiety Symptomatology at Follow Up*

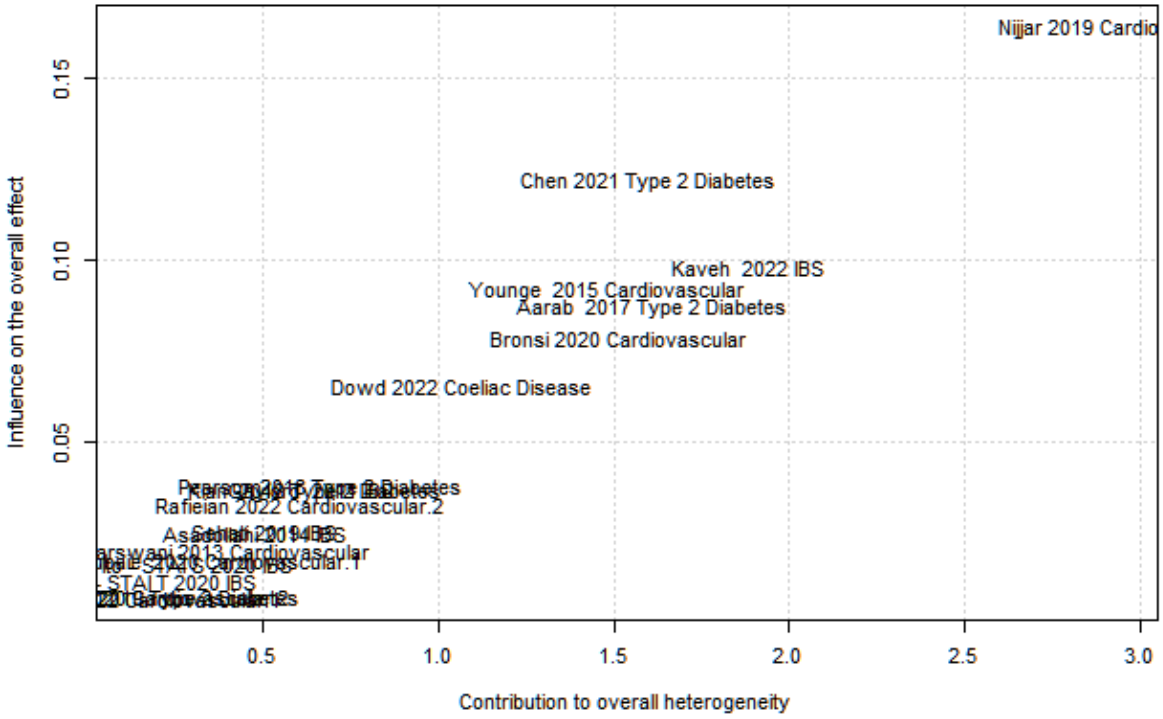


**The Impact of Influential Primary Studies**

The impact of disproportionately influential studies was assessed using a "leave-one-out" analysis and is presented on the Baujat plot (Baujat, Pignon, & Hill, 2002) in Figure 13.

**Figure 13**

*Baujat Diagnostic Plot Of Sources Of Heterogeneity: Indicating Nijjar (2019) contributes to the overall heterogeneity.*




***Note: The vertical axis reports the influence of the study on the overall effect and the horizontal axis reports the discrepancy of the study with the rest of the literature.*

As observed in Figure 13, the study by Nijjar (2019) reports estimates of treatment efficacy that were influential upon the overall weighted average treatment effect. Consequently, the random effects model was recalculated with Nijjar (2019) removed. The corrected random effects model reported a synthesis of SMD = -1.1127 (95% CI [-1.5735 to -0.6519]) and evidences an increase of approximately 9.3% relative to the uncorrected estimate. This would

not alter the substantive conclusions from this meta-analysis; therefore, it may be inferred that removing any study will not result in a quantitatively different conclusion and no study is exerting excessive influence on the outcome.

### The Effect of Risk of Bias in the Included Studies

To assess the impact of the study level risk of bias upon heterogeneity, a series of subgroup analysis were conducted on the study level standardised mean differences for the risk of bias ratings of "low risk" and "any risk" (i.e., unclear risk and high risk of bias combined) for each of the seven types of methodological bias.

**Table 9**

*Comparison Of Standardised Mean Differences for Studies Rated As Low Risk Or Any Risk Of Bias*

| | Low Risk | | | Any Risk | | | | |
|---|---|---|---|---|---|---|---|---|
| | **EFFECT** | **95% CI** | **k** | **EFFECT** | **95% CI** | **k** | **$X^2$** | **P** |
| **Selection Bias** | -0.1460 | -0.3903 to 0.0984 | 7 | -1.4196 | -2.0176 to -0.8216 | 13 | 14.93 | **0.0001** |
| **Performance Bias** | -1.2267 | -1.7499 to -0.7036 | 16 | -0.1138 | -0.4596 to 0.2321 | 4 | 12.10 | **0.0005** |
| **Detection Bias** | -0.1460 | -0.3903 to 0.0984 | 7 | 1.4196 | -2.0176 to -0.8216 | 13 | 14.93 | **0.0001** |
| **Statistical Bias** | -0.4755 | -0.9043 to -0.0466 | 4 | -1.1493 | -1.6904 to -0.6082 | 16 | 3.66 | 0.0558 |
| **Reporting Bias** | -0.7594 | -1.2288 to -0.2899 | 14 | -1.6199 | -2.3656 to -0.8741 | 6 | 3.66 | 0.0556 |
| **Generalisability Bias** | -0.5909 | -1.1290 to -0.0527 | 7 | -1.2445 | -1.8618 to -0.6272 | 13 | 2.45 | 0.1178 |

**Significant findings are highlighted in bold*

Table 9 shows significant differences in weighted average standardised mean differences were observed for selection bias, performance bias, and detection bias, also visually depicted in Figure 14, Figure 15 &

Figure 16). In addition, statistical and reporting biases evidenced trends toward significance. Overall, suggesting that selection bias, performance bias, and detection bias are significantly impacting the overall conclusions of this meta-analysis and future studies should make effort to overcome these deficiencies in the existent literature.

**Figure 14**

*Subgroup Forest Plot depicting Selection Bias is significantly impacting results of the meta-analysis*

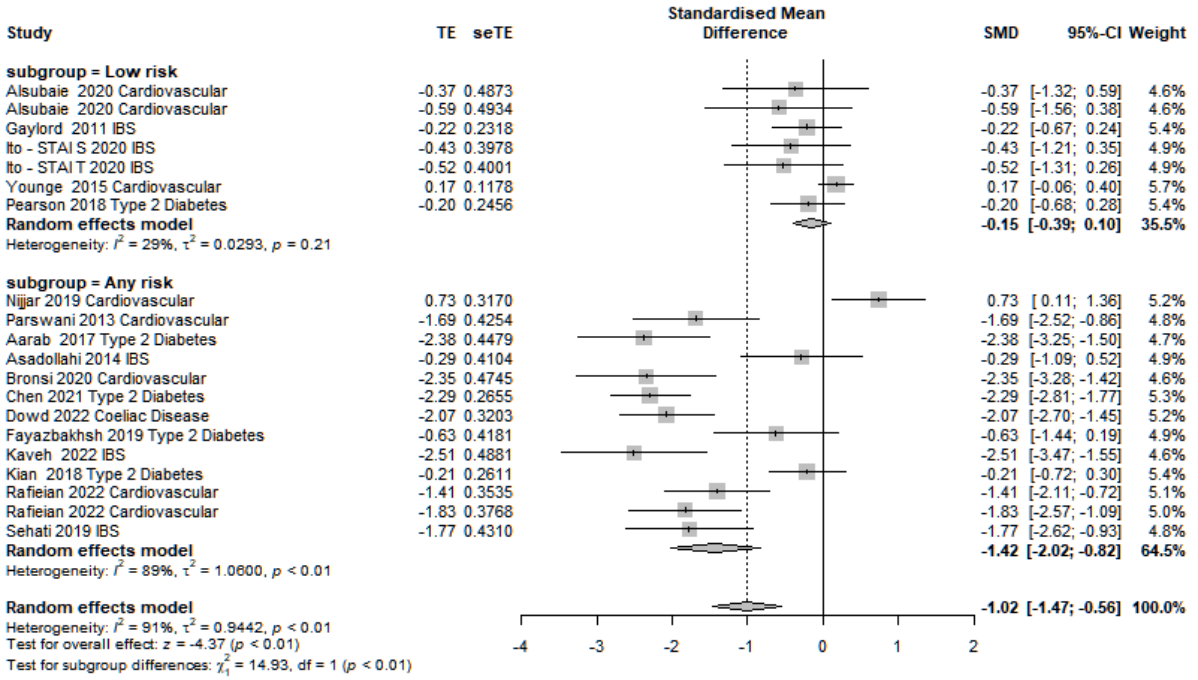


**Figure 15**

*Subgroup Forest Plot depicting Performance Bias is significantly impacting results of the meta-analysis*

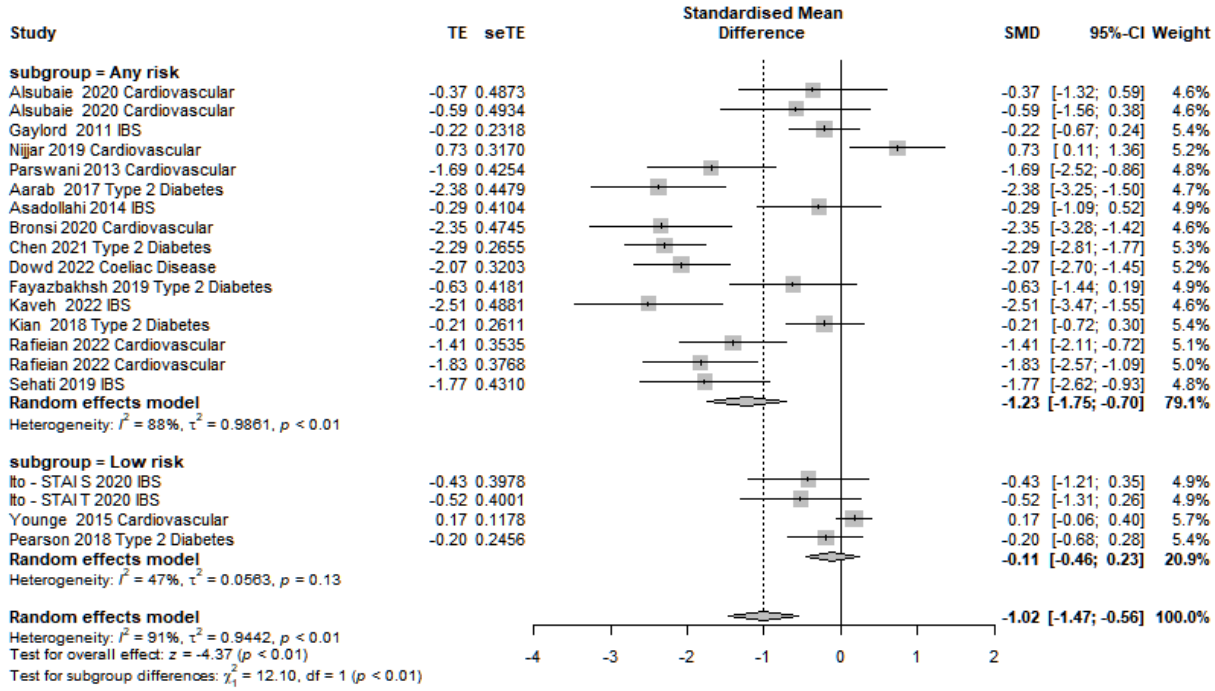
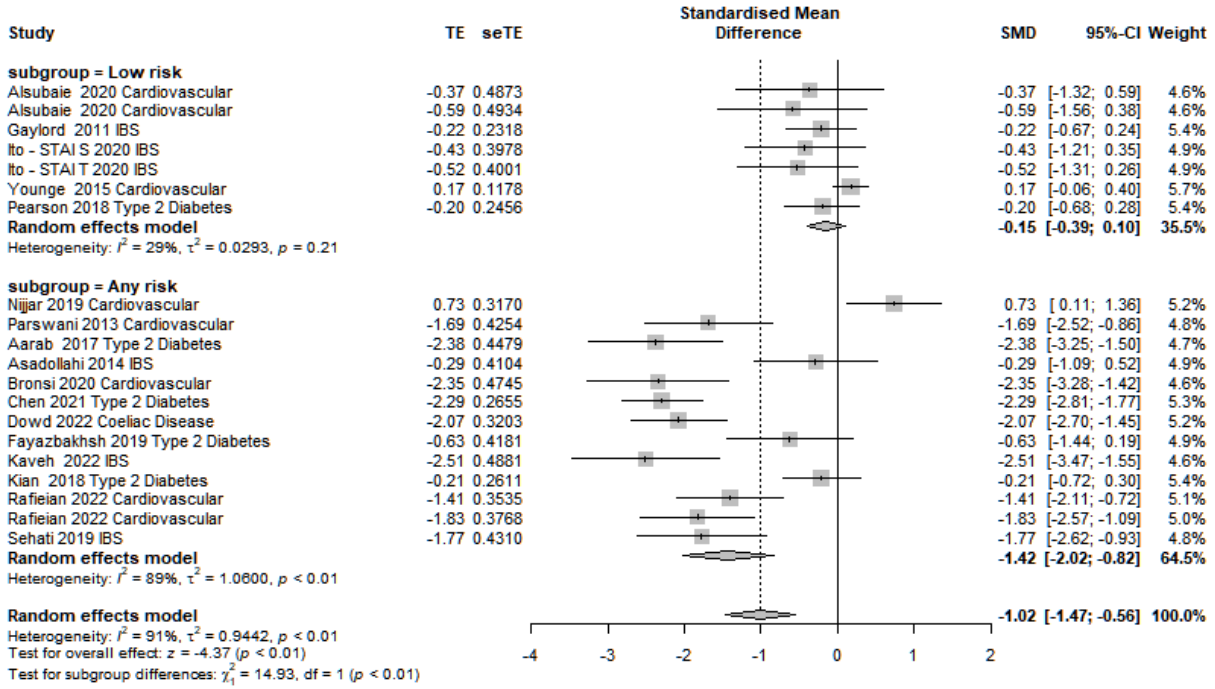



**Figure 16**

*Subgroup Forest Plot depicting Detection Bias is significantly impacting results of the meta-analysis*

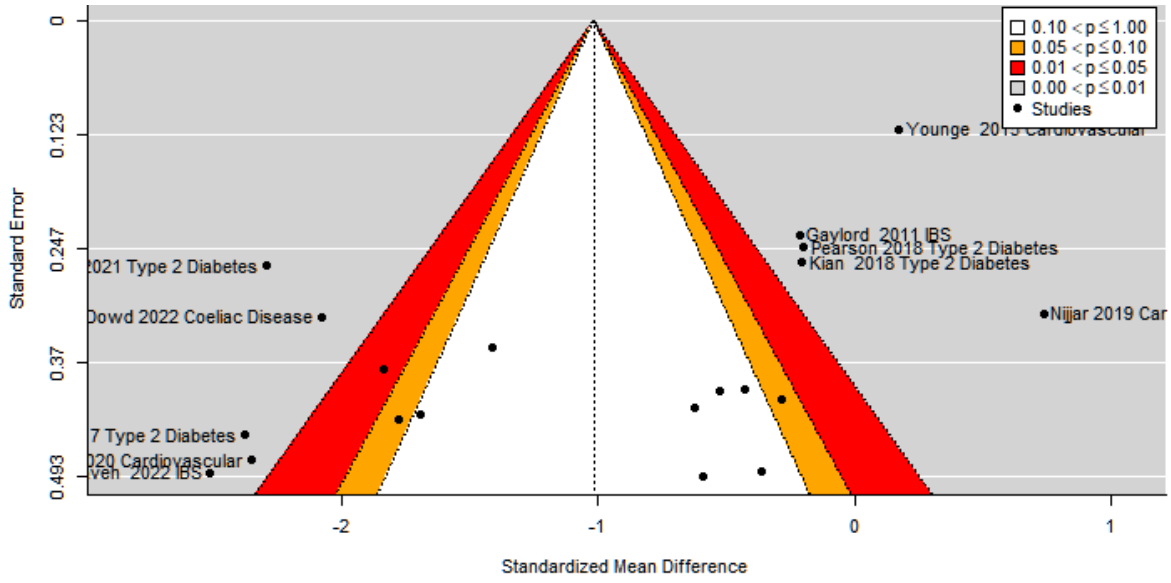


**The Impact of Publication and Small Study Biases**

The funnel plot of the study level standardised mean differences plotted against study level standard error is presented in Figure 17.

**Figure 17**

*Contour Enhanced Funnel Plot Of The Study Level Standardised Mean Differences Plotted Against Study Level Standard Error*




***Note: The 95% confidence interval of the expected distribution of treatment effects is shown as an inverted "funnel".*

Figure 17 shows there is clear evidence of the, previously noted, heterogeneity of the reported effect sizes (i.e., the large number of studies that are outside of the expected confidence interval for the weighted average standardised mean difference). However, there is no evidence of publication bias since there are a small number of studies in the area of the funnel plot which would be associated with null effects and publication bias. Therefore, no simulation or adjustments for publication bias and small study effects was undertaken.

Rosenthal (1979) describes the calculation of a failsafe number; this method calculates the number of non-significant results needed in the meta-analysis for the overall effect to be non-significant ($p > 0.05$). This procedure suggests that 1008 studies would be required to reduce the observed SMD to non-significance, suggesting that the observed SMD is robust to studies missing due to publication bias.

**Results Summary**

There was a significant difference for ACT, CFT and DBT interventions for anxiety in people with dietary managed chronic health conditions; the treatment effects were maintained at follow up for ACT and CFT. However, as a high level of heterogeneity was observed for MBSR, the impact of disproportionately influential studies was assessed. The study by Nijjar. (2019) reports estimates of treatment efficacy that were influential upon the overall weighted average treatment effect, however the analysis showed that removal of the study would not alter the conclusions of this meta-analysis.

**Efficacy Of Third-Wave Interventions For Quality Of Life In People With Dietary Managed Chronic Conditions**

There were thirteen studies that investigated the efficacy of third-wave interventions for QoL in people with dietary managed chronic health conditions. There were four MBSR interventions studies, five ACT studies, three MCBT and one DBT.

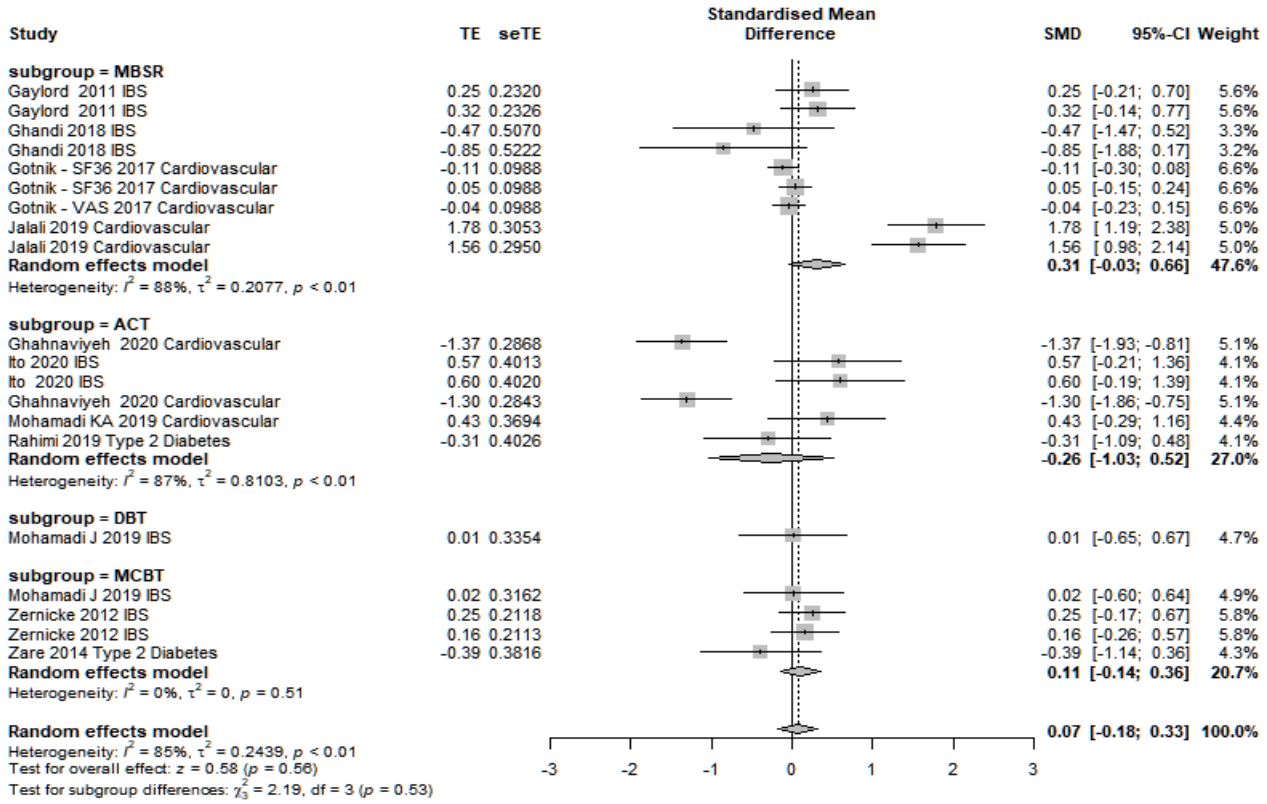
The treatment efficacy for the separate, individual, third-wave interventions for QoL are shown in Figure 18, a negative standardised mean difference favours the intervention. A non-significant treatment effect favouring the treatment group was observed for all interventions; MBSR (SMD = 0.31, 95% CI [-0.03 to 0.66]), ACT (SMD = -0.26, 95%

CI [-1.03 to 0.52]), DBT (SMD = 0.01, 95% CI [-0.65 to 0.67]) and MCBT (SMD = 0.11, 95% CI [-0.14 to 0.36]).

Figure 18 also indicates that there was no evidence of a meaningful treatment effect ($z$= 2.19, $p$ = 0.58) for QoL in any of the third-wave psychological interventions, therefore no further analysis was carried out.

**Figure 18**

*Forest Plot depicting no significant effects of interventions in QoL Symptomatology At End of Therapy*




***Note: Some studies may be mentioned more than once due to multiple anxiety measures being used.*

# DISCUSSION

The aims of this meta-analysis were (i) to conduct a systematic search of the literature, to identify papers that report anxiety, depression, and QoL outcomes in people with common dietary-managed chronic health conditions that have received a third-wave psychological intervention; (ii) to perform a meta-analysis to determine if third-wave interventions are effective in the treatment of depression symptomatology, anxiety symptomatology and QoL in people with dietary managed chronic health conditions; (iii) to appropriately conduct further analysis to explore the presence of heterogeneity in the included papers. To the best of the author's knowledge, the study is the first to investigate the effects of third-wave interventions in people with dietary-managed chronic health conditions, therefore no similar studies were available for comparison.

The first aim was met by conducting a thorough systematic search of the literature as described in the methodology and presented in the PRISMA diagram. Interestingly, the majority of the literature on psychological interventions within chronic health conditions predominantly focuses on CBT despite the increase in utilisation of third-wave interventions (Hayes & Hofmann, 2021). It was found that the term 'dietary-managed' within chronic health conditions is not commonly used and instead the term 'self-management' is focused upon. However, this broad term encompasses dietary management, medication adherence, psychoeducation and other factors with a physical and mental health focus, therefore it can be helpful to identify and explore specific conditions requiring significant dietary adaptations (Ojo, 2019). From the final studies included, it was observed that a large proportion of literature had been carried out in Iran, potentially due to a change in focus towards 'self-management' of diseases in the country (Masoumi et al, 2021). However, there could be cross-cultural implications of this due to differences in beliefs, practices and social norms which

consequently, impact the generalisability of the findings across cultures and countries (Marmot, 2005). Furthermore, in Iran, there may be differences in how research is conducted, diet and their how healthcare systems operate. The second aim was met by completing a meta-analysis using the random effects model and the third aim by testing for heterogeneity using the "leave one out" analysis and through subgroup analysis.

Firstly, the findings have shown support for the effectiveness of ACT for IBS (Ito & Muto, 2020) and T2D (Aarab Shaibani, 2017; Fathi et al., 2016) and CFT for IBS (Kaveh et al., 2022) (Afshar-Zanjani et al, 2021) and Coeliac Disease (Dowd et al, 2022) for depression. Evidence in support of CFT interventions for people with depression symptomatology in other non-dietary managed chronic health conditions was also found in a meta-analysis by Mistretta & Davis, (2022), with effects being maintained after a one to three month follow-up, however effects were small. It is worth noting that of the eighteen studies included in the analysis for depression, only six studies comprised of significant findings, once (Mirsharifa et al, 2019) was removed due to high levels of heterogeneity. This low sample of studies may impact overall generalisability of findings.

For anxiety, significant differences were present for ACT, CBT and DBT for the treatment efficacy of the third-wave interventions, with the treatment effects being maintained at follow up for ACT and CFT. However, only three studies reported an ACT intervention and the chronic health conditions investigated were; IBS (Ito & Muto, 2020) and T2D, (Aarab, 2017, Fayazbakhsh & Mansouri, 2019). Four studies reported a CFT intervention, the chronic health conditions included were; Cardiovascular Disease (Bronsi et al, 2020; Rafieian et al, 2022), Coeliac Disease (Dowd et al, 2022) and IBS (Kaveh et al, 2022). The current study did not identify any effects for MBSR and MBCT, however another meta-analysis (Jenkinson et al, 2022) found MCBT to be significant at targeting anxiety in people with Type 1 and Type 2 diabetes.

Interestingly, no evidence of a meaningful treatment effect for QoL was present in any of the third-wave psychological interventions but these findings must be interpreted with caution due to the low sample of studies in each of the conditions and interventions not being tailored towards improving QoL. A similar meta-analysis of nine studies by Ni et al, (2020) in people with both Type 1 and Type 2 diabetes, that included one common paper (Hartmann et al, 2012), found a significant effect favouring MBSR and MCBT on depression and QoL. A subgroup analysis was not conducted to determine if there were differences within Type 1 and Type 2 diabetes, which could potentially explain the difference in findings. Additionally, a meta-analysis by Graham et al, (2016) found improvements in QoL in people with other chronic health conditions, HIV, epilepsy, and cancer. Yet, similar to this study, effect sizes were small, and studies were low in quality, highlighting the need for further research using better methodological procedures.

The current study followed a stringent inclusion and exclusion criteria within some domains. For example, a decision was made to be selective over the dietary-manged conditions chosen following extensive research in chronic health literature. The four chosen conditions were frequently mentioned in papers investigating the role of nutrition and diet on chronic health disease (Clark, 2003; Ojo, 2019; Schulze et al, 2018). There were aspects of the inclusion criteria that were more flexible, for example, the method of intervention delivery (face-to-face, online), the facilitator delivering the intervention and intervention length. These are all factors that may have influenced the findings, however as there are no previous studies in this area, it was important to gather an overall idea into the effectiveness for 'third-wave' interventions within this population group. Although the 'flexible' inclusion criteria allowed for more studies to be included, varying study methodologies could explain the high levels of heterogeneity potentially impacting performance bias.

A similarity found between the current meta-analysis and other meta-analyses conducted in people with other chronic health conditions, concludes that studies are of poorer quality overall (Graham et al, 2016; Ni et al, 2020), as reflected in the risk of bias and quality index scores. A selection of the included studies had low sample sizes (Parswani et al, 2013; Ghandi et al, 2018) of fifteen and sixteen participants respectively and poorer methodology, despite the majority being randomised controlled trials. A study into the effectiveness of mindfulness interventions (Aucoin et al, 2014) in IBS which included two of the same studies as the current review (Zernicke et al, 2011) concluded that 'substantial improvements in methodological quality and reporting are needed' for future research. This would improve the validity and replicability to ensure implications in clinical practice. In the current meta-analysis, many studies scored in the high or unclear risk for performance bias, treatment fidelity and generalisability. Therefore, findings should be interpreted with caution as high risk of performance bias indicates results may have been influenced by other factors than the intervention being investigated. High risk of treatment fidelity in the study may lead to an underestimation of the treatment effects being measured as delivery and/or reporting of the intervention may not have been clearly described. Finally, high risk of generalisability means the utilisation of third-wave therapies for dietary managed chronic health conditions for depression symptomatology in other population groups should be carefully considered.

Additionally, it was observed that current existing literature primarily focuses on many other outcomes aside from depression and anxiety, hence explaining the low number of studies within each intervention and for the chronic health conditions being investigated. For example, other meta-analysis in T2D often focused on adherence, diabetes-related distress and HbA1c levels (Ngan et al, 2021; Schmidt et al, 2018) reviews into IBS focused on overall psychological distress (Henrich et al, 2015), and gastrointestinal symptoms (Laird et al, 2016).

**Limitations and Future Research**

The current study and similar meta-analysis (Ni et al, 2020; Veehof et al, 2016 ) that have researched the effectiveness of third-wave psychological interventions in other chronic health conditions have concluded that the quality of studies is generally poor. Studies require methodological improvements in participant recruitment, randomisation processes, the quality of interventions delivered and also in the clarity of reporting findings.

Of the studies that were included, there were huge variations in mode of intervention delivery: online (Guo et al, 2022), group sessions (Maghsoudi et al, 2019) and through the use of self-guided therapy (Pearson et al, 2018). Furthermore, the facilitators profession and the training received varied considerably, from masters students (Garland et al, 2012), nurses (Chen et al, 2020) to clinical psychologists (Rafieian et al, 2022.) A factor which may have impacted the quality of the intervention received by participants. There were also nine studies that did not mention the details of intervention facilitators. This is important to note because it impacts the replicability of studies and understanding into its entire methodology.

In terms of the intervention, there were variations in the length and duration of sessions. Although on average most studies conducted an eight-session intervention, others were twelve weeks (Gotink et al, 2017) and some four weeks (Dowd et al, 2022). Furthermore, the measures used across studies varied greatly across the three measured outcomes and some studies used translated versions of common measures (Chen et al, 2020). On one hand, the translating of measures can be helpful as it allows for cross-cultural comparisons, increased accessibility, and diversity of participants. However, the reliability and validity may be reduced due to inaccuracies in translation. It is worth noting that all studies relied opon the use of self-report questionnaires for measuring depression and anxiety. Participants of the studies also had varying lengths of diagnosis for depression and anxiety, consequently impacting the generalisability of results.

Another limitation was the small number of studies available for each of the chronic health conditions and for the third-wave intervention provided, despite the prevalence of depression and anxiety in people with chronic health conditions (Barberis et al, 2019; Violato & Gray, 2019). For example, only one paper met the criteria for Coeliac Disease (Dowd et al, 2022), therefore generalising results is problematic. Future research would benefit from focusing on individual, group and web-based interventions separately and also control for the frequency, duration, and facilitators of sessions to determine component effectiveness. Given that the majority of research conducted is in Iran, empirical studies would benefit from being carried out in other countries, particularly where third-wave interventions are more commonly used and where prevalence of those chronic health conditions is higher, to ensure appropriate and evidence-based interventions are being provided.

For future, the methodology of the current study could be replicated by potentially incorporating non-peer reviewed studies. The decision was made to only include peer-reviewed studies as these have usually gone through rigorous review processes, ensuring it is of high quality. However, this consequently eliminates the possibility of 'grey literature' being included that may have assisted in drawing further clinical conclusions.

**Clinical Implications**

The overall findings of the study suggests that ACT and CFT appear to be effective in reducing anxiety and depression symptoms in people with dietary-managed chronic health conditions and there is preliminary support for the utilisation of DBT for people with chronic health conditions. Healthcare professionals working with people with those chronic health conditions should screen for depression and anxiety and together with the individual consider if psychological therapies are warranted. This could be carried out at routine or specialist appointments. For professionals delivering psychological interventions, findings of this study

indicate it may be helpful to consider interventions, accordingly, depending on the diagnosis and the presenting difficulties. For example, ACT may be considered for IBS and T2D, and CFT may be considered for IBS and CD in people with depression. ACT may also be considered for IBS and T2D for people with anxiety, and CFT for Cardiovascular Disease, CD and IBS in people with anxiety.

Therapists may wish to consider specific ACT or CFT techniques, such as self-compassion strategies and acceptance-based work, that can interchangeably be incorporated alongside other therapies. Additionally, given the close links between physical and mental health condition in those with dietary-managed conditions, clinicians may wish to consider the impact and potentially burden of having to manage and adhere to specific diets. There may be people who are struggling to accept the changes required to manage their condition or may see having the condition as a burden, thus contributing to poorer mental health. As CFT, promotes strategies towards being self-compassionate and less self-critical, it is recommended to explore the beliefs, emotions, and behaviours that people have towards their dietary regimen and the cognitions and behaviours that they may exhibit in the event of non-adherence to the diet. Those with more negative dietary perceptions may benefit from a third-wave intervention. Furthermore, ACT strategies that work on the acceptance of difficulties may support those who are struggling to accept the dietary adaptations required in order to manage their condition.

Finally, services would benefit from exploring if clinicians are using third-wave interventions individually or embedding techniques in combination with other therapies. From a clinical and research perspective, future research investigating the use of third-wave interventions within clinical practice in the management of dietary-conditions, would help to identify the current utilisation of strategies and techniques and clinicians' attitudes towards them. This would be helpful to identify if further training is required, to ensure clinicians are

providing evidence-based and effective psychological interventions to those with chronic health conditions.

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**Chapter 2. Empirical Research Paper:** What Is The Relationship Between Self-Compassion, Perfectionism, Dietary Adherence, And Quality Of Life In People With Coeliac Disease?


## ABSTRACT

### Background

Coeliac Disease (CD) is a chronic condition that is managed by adhering to a gluten-free diet. Factors such as food attitudes and behaviours are associated with dietary adherence and Quality of Life (QoL) in people with CD, however the role of perfectionism has not previously been investigated. Perfectionism is associated with lower QoL in people with other chronic health conditions and linked to lower levels of self-compassion. This study aims to explore the interrelationships and mediating effects between self-compassion, perfectionism, food attitudes and behaviours, on dietary adherence and QoL.

### Methodology

A cross-sectional study was conducted where 458 international participants with CD completed an online questionnaire. Data were collected using the following measures: The Self-Compassion Scale (SCS), The Frost Multidimensional Perfectionism Scale (FMPS), The Coeliac Disease Quality of Life survey (CD-QOL), The Celiac Dietary Adherence Test (CDAT), and The Coeliac Disease Food Attitudes and Behaviours Scale (CD-FAB).

### Results

Pearson's correlation showed significant associations between self-compassion, perfectionism and food attitudes and behaviours with dietary adherence, and only self-compassion predicted dietary adherence in a regression model. Pearson's correlation also

showed age, age of diagnosis, length of diagnosis, self-compassion, perfectionism, food attitudes and behaviours and dietary adherence had significant relationships with QoL. The regression model showed food attitudes and behaviours and dietary adherence significantly predicted QoL. There were no mediating variables that influenced dietary adherence or QoL. However, the direct relationships remained significant in the presence of the mediators.

**Conclusions**

This study demonstrates that self-compassion is an important psychological factor to consider in the management of CD and factors such as perfectionism and food attitudes and behaviours should be taken into consideration.

# INTRODUCTION

## What Is Coeliac Disease?

Coeliac Disease (CD) is a chronic autoimmune condition that is triggered by exposure to gluten in genetically predisposed individuals (NICE, 2023). Upon the ingestion of gluten, the body's immune system attacks its own tissues and produces antibodies; these antibodies damage the lining of the small intestine impairing its ability to absorb nutrients from food leading to nutritional deficiencies (Fasano, 2009). Glutens are dietary proteins found naturally in grains such as wheat, barley and rye (Lebwohl et al, 2018), providing approximately 50% of the caloric intake in Western and developing countries (Raiteri et al, 2022). These grains are used to make several foods, such as bread, cereals, and pastas. Gluten is found in many processed foods, including: soups, processed meats, condiments, in some beverages (Gandy, 2019) and in a few cosmetic products (e.g., toothpaste, lipsticks), (Machado, 2023).

Whilst some people with CD do not experience any known symptoms (Coeliac UK, 2023), the consumption and cross-contamination of even small amounts of gluten in some people with CD can result in varying and often debilitating symptoms across individuals. Symptoms can include diarrhoea, nausea, stomach cramps and vomiting for several days. For some people, long-term symptoms may include infertility, anaemia and bone disease (Lebwohl & Rubio-Tapia, 2021). The only available treatment for CD is adherence to a lifelong gluten-free diet which can reverse damage to the mucosa (lining) of the small intestine, reduce mortality and improve symptoms for the majority of people (Lee, 2022).

## The Prevalence of Coeliac Disease

Coeliac Disease is considered a major public health concern, with rising prevalence rates in both adult and paediatric populations. Whilst known prevalence of CD is currently 1.4% globally (Singh et al, 2018), it is thought to be underdiagnosed. For example, in the UK

CD affects 1 in 100 people but only 36% of those who have the condition have been diagnosed, meaning half a million people have no diagnosis (Coeliac UK, 2023). A national survey in the USA found 80% of people were undiagnosed in 2009 and this decreased to less than 50% in 2013 (Lebwohl et al, 2018). In Europe, Sweden (3%) and Finland (2.4%) have the highest prevalence, potentially due to mass testing, and Germany has the lowest (0.7%). CD is not only present in the Western world, the disease is becoming increasingly prevalent in India (Krigel et al, 2016) and Africa, Algeria reported prevalence rates of 5.6% (Lerner, 2019). In terms of gender, there appears to be a gender bias in the diagnosis of CD, with women being two to three times more likely than men to have a diagnosis (Caio et al, 2019).

**Symptoms and Comorbidity**

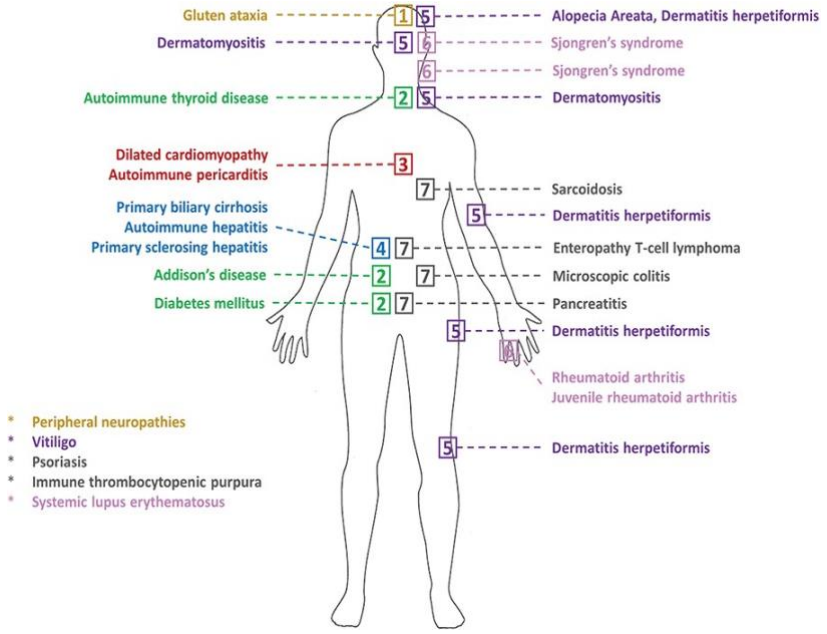
CD presents both gastrointestinal and non-gastrointestinal symptoms (Taylor et al, 2019). Common gastrointestinal symptoms include diarrhoea, abdominal pain, bloating, constipation, and indigestion. Non-gastrointestinal symptoms include anaemia, osteoporosis, neuropathy, ataxia, fatigue and delayed puberty (Jericho et al, 2017).

The increased rates of somatic and psychological comorbidity have been found to play a key role in conditioning the perceived health status and burden in CD (Usai et al, 2022). People with CD have been found to be at increased risk for numerous other health conditions, including other autoimmune diseases such as Hashimoto's and Type 1 Diabetes (Fasano, 2006). The evidence also suggests an increased risk for cardiovascular disease (Bernardi et al, 2023) whilst failure to adhere to a gluten-free diet increases the risk of developing cancers, such as colon cancer (Kalra et al, 2022). Furthermore, untreated CD has been found to impact bone mass density, increasing the risk of fractures (Zanchetta et al, 2015), affecting reproductive health (Pogačar et al, 2019) and cognitive functioning and psychiatric conditions in some people (Laurikka et al, 2022). People with CD often have to manage and adhere to multiple

medical regimens, thus lowering overall Quality of Life (QoL) (Cossu et al, 2017; Stallmach et al, 2006). Figure 19 provides a visual representation on some of the co-morbidities associated with CD (Del Prete et al, 2020).

**Figure 19**

*Comorbidities Map in Coeliac Disease*




**Permission to use this image was granted on 22/03/2023 by Angelo Facchiano, co-author of the paper.*

## Coeliac Disease and Mental Health

The relationship between CD and mental health disorders is a complex interaction, often split into specific and non-specific mechanisms (Smith & Gerdes, 2012). Specific mechanisms refer to biological processes, e.g. 'the gut-brain axis' that can produce overlapping pathologies and inflammation in the body contributing to anxiety and depression (Parisi, 2018). Non-specific mechanisms include psycho-social factors, for example anxiety related to food choices, social situations, and feeling isolated and burdened (Mirijello et al, 2019). Findings by Canova et al. (2021) highlighted that people with CD had significantly higher levels of anxiety in comparison to healthy controls. A recent meta-analysis by Sharma et al (2021) found

people with CD were significantly more likely to experience depression in comparison to controls, a moderate risk was observed for anxiety and a significant risk of developing panic disorder; no associations were found between CD and schizophrenia or bipolar disorder. Another meta-analysis (Clappison et al, 2020) reported similar findings and additionally found a significant increased risk for autism spectrum disorder, ADHD, and eating disorders in CD participants compared to controls.

**Coeliac Disease and The Impact on Quality of Life**

There are multiple factors related to CD that can contribute to an individual's mental health and QoL (Theethira et al, 2015). People often live with an array of symptoms for many years, with diagnostic delays of up to an average of 10 to 13 years (Cichewicz et al, 2019; Norström et al, 2011;) from the first onset of symptoms. The diagnostic testing process can be challenging, as it involves the re-introduction of gluten for those who have ceased it prior to having a blood test to test for antibodies and biopsy of the small intestine (Lewis et al, 2017), potentially leading to the aforementioned symptoms for a period of time. Following on from a diagnosis, the adherence to a strict gluten-free diet requires education on the nutritional, cultural, social and environmental impact of the diet, all of which will impact dietary behaviours and food choices at every mealtime (Theethira et al, 2015). In a recent study, food attitudes and behaviours have been found to be associated with diminished QoL (Gholmie et al, 2023). Food attitudes and behaviours in the context of Coeliac Disease refers to the thoughts, beliefs and actions an individual has towards their chronic condition. Attitudes towards food may involve concerns about cross-contamination of gluten both at home and when eating away from home. The behavioural aspect may include avoidance of socialising and travelling for example and over-planning and preparing to avoid cross contamination (Gholmie et al, 2023; Satherley et al, 2018). Due to the vast variety of foods containing gluten, the diet can be

restrictive, difficult to follow and accept, with increased preoccupation with food and heightened awareness of bodily sensations (Möller et al, 2021). Furthermore, as gluten can be found in some religious ceremonial foods, cultural adaptations may be required (Shaoul, 2019).

For some people, the continued frustration of managing life-long dietary changes impacts social functioning and QoL, the prospect of eating out can be an 'embarrassing experience' if gluten-free foods are not available (Taylor et al, 2013). It has been suggested that strict dietary adherence in CD may lead to a state of 'anxious hypervigilance' (Ludvigsson et al, 2018). Addolorato et al. (2008) reported people frequently feel embarrassed and experience social anxiety, leading to 'social retirement'. Additionally, increased anxiety regarding cross-contamination of food is also experienced, this can happen when traces of gluten are left on cooking utensils, in toasters and worktops (Leonard et al, 2017), often making dining out and travelling difficult experiences.

Gluten-free products have been found to be of poor nutritional quality, due to lower iron, fibre and protein content and higher sugar and fat content (Jamieson et al, 2018). Nutritional deficiencies of iron, zinc, calcium, Vitamin B and 12 are common, particularly in those who have been newly diagnosed and in those who have been following a gluten-free diet for some time (Rinninella et al, 2021), potentially leading to further complications and diseases such as cardiovascular disease (Bernardi et al, 2023b) .

The cost of gluten-free foods is significantly higher than gluten-containing foods. Internationally, on average, cost of gluten-free staple foods such as flour, pasta and bread are 131% higher than the gluten-containing equivalents (Jegede et al, 2021), potentially leading to further anxiety and financial burden. Furthermore, gluten-free food can be difficult to obtain in some social settings and countries, consequently limiting socialising and travelling for many people.

There are several psychosocial processes associated with QoL in people with CD. Möller et al. (2021) found the relationship between QoL and gastrointestinal symptoms were statistically mediated by negative illness perceptions, maladaptive coping, pain catastrophising, psychological inflexibility and poorer QoL, thus impacting adjustment to the disease. In a qualitative study (Taylor et al, 2013) people with CD reported initial relief at receiving a diagnosis, but later reported feeling angry, bitter and frustrated. It has been reported that the mental health of women declines following diagnosis (Sverker et al, 2009). In a Maltese study, 77% of individuals felt that others did not understand their dietary needs, 38.5% avoided social activities due to their dietary requirements and 76% experienced difficulties in finding suitable food when out of the home (Gauci et al, 2023). Conversely, there are studies that have reported improved QoL following diagnosis and adherence to a gluten-free diet (Gray et al, 2010; Majsiak, 2021), thus indicating that QoL may improve with time.

**The Concept of Perfectionism**

The role of perfectionism in chronic health conditions is increasingly being researched (Molnar et al, 2012; Shanmugasegaram et al, 2014). Perfectionism is a multidimensional personality trait that represents a chronic source of pressure that others expect and demand perfection from an individual, consequently eliciting extreme feelings of hopelessness and helplessness when not achieved (Flett et al, 2022).

The concept of perfectionism being seen as maladaptive is consistently supported by a number of studies, with the multiple facets of socially-prescribed perfectionism being found to be associated with increased burnout (Curran & Hill, 2019), rumination (Xie et al, 2019), suicidal tendencies (Smith et al, 2018), and poorer mental health in those with eating disorders (Castro-Fornieles et al, 2007), all factors that have also been expressed by those with CD. A longitudinal study on perfectionism in older adults (Fry & Debats, 2009) found that the risk of

death is 51% greater in those with high perfectionism scores than low scores, additionally the risk of death reduced by 26% in those that were more conscientious. Similar findings describing the association between the pressure to meet the expectations of others and mortality were also found (Weinstein et al, 2019), highlighting that a constant sense of feeling pressured and a lack of autonomy are linked to earlier deaths in the general population.

A study (Xie et al, 2019) explaining 'The Perfectionism Cognition Theory' outlined that worry and rumination mediated the relationship between perfectionism, distress and physical illness. The theory helps to provide an understanding into the role perfectionism plays in individuals with chronic illnesses, given the elevated levels of anxiety, depression and distress experienced in this population group. Perfectionism has been associated with lower QoL of life in people with both chronic conditions and those without. In a study of people with eating disorders, perfectionism mediated the relationship between symptomatology and QoL (Rutter-Eley et al, 2020). Similarly, perfectionism mediated the relationship between emotional distress and QoL in people with chronic back pain (Ardalani Farsa et al, 2021). In people with chronic fatigue syndrome, perfectionism has been found to predict fatigue and pain symptoms (Kempke et al, 2013). Adults with higher levels of diabetes-related distress were found to have higher levels of perfectionism (Moran, 2020).

Some studies have found perfectionism to be 'adaptive' in people with chronic conditions. A study looking into the coping strategies and personality traits affecting adherence to a gluten-free diet in adolescents with CD found those scoring higher in perfectionism were more adherent to a gluten-free diet and were less likely to use emotional and avoidance coping strategies (Wagner et al, 2016). As existing literature on perfectionism and CD is limited, other studies investigating perfectionism and disordered eating were looked at, given the varied impact CD has on eating patterns (Satherley et al, 2017). In a participant group without CD, adherence to food rules was significantly related to perfectionism, and adherence to rules was

found to mediate the relationship between perfectionism and disordered eating (Brown et al, 2012).

At present, research into the relationship between CD and perfectionism is limited. However, given that perfectionism and CD individually are linked to poorer mental health and QoL, and the associations present between perfectionism and other chronic conditions, it is important to consider the role of perfectionism in people with CD. It is possible that people with CD may develop perfectionistic tendencies because of the challenges in adhering to a gluten-free diet that requires significant discipline, meticulous self-management, and hyper-vigilance to the presence of gluten, thus impacting their food attitudes and behaviours.

**The Connection Between Perfectionism and Self-Compassion**

It has been established that maladaptive perfectionism predicts lower levels of self-compassion (Linnett & Kibowski, 2020; Yeshua et al, 2019). Theoretical explanations of this relationship within chronic conditions focus on self-criticism, an aspect that is higher in people that have perfectionistic traits due to the perceived struggle and fear of having to achieve high standards, engaging in unhelpful avoidance and checking behaviours in relation to their health conditions (Biber & Ellis, 2019). The harsh self-criticism can lead to a lack of self-acceptance and undermine self-compassion leading to poorer health related behaviours (Kelly et al, 2010) and cognitions such as self-blame and emotions such as guilt and shame, as is commonly seen in people with eating disorders. In people with eating disorders, there is often an uncompassionate attitude towards oneself and relationships with food, driven by a desire to achieve perfectionism to control body image and food intake (Neff, 2007; Sirois et al, 2016). Engaging in a process of self-criticism is not uncommon for people with CD, particularly in relation to feeling like a burden to others for meal planning and feeling guilty in not being able to manage symptoms (Sainsbury et al, 2018), thus potentially being influenced by food

attitudes and behaviours. For example, people with chronic pain may engage in a cycle of criticism when unable to continue with their usual activities or people with diabetes may lack self-compassion when their blood sugar levels are unregulated (Kempke et al, 2014).

**The Concept of Self-Compassion**

People with chronic conditions experience illness-related demands and stressors that can significantly impact their Quality of Life, mental and physical health (McWilliams et al, 2003). The daily management of the condition(s) often include efforts to mitigate symptoms, for example following specific treatment regimens and attending appointments and trying to cope with the psycho-social factors of maintaining ones independence; future uncertainty and changes in social lives (Mistretta & Davis, 2022c) can impact one's ability to be self-compassionate.

Self-compassion refers to treating oneself in a kind and non-judgmental manner rather than being self-critical, even in the presence of distress and suffering (Neff, 2003). Self-compassion is made up of three components: self-kindness, common humanity, and mindfulness. Studies suggest that self-compassion promotes effective coping and enhanced wellbeing in healthy people (Kirby et al, 2017). In those with chronic illnesses, self-compassion has been associated with better adjustment (Sirois et al, 2015), better emotional regulation through promoting changes in affect, attention and self-efficacy (Sirois & Rowse, 2016). Higher levels of self-compassion have also been found to mediate the relationship between negative illness beliefs and anxiety in cancer patients (Gillanders et al, 2015).

Several studies have highlighted the link between self-compassion and QoL in people with chronic conditions, this is because self-compassion is associated with lower anxiety, depression, stress, and increased resilience (Neff & McGehee, 2010) and can lead to better physical and clinical health outcomes (Misurya et al, 2020). Self-compassion was associated

with valued living and better psychological functioning in those with chronic pain (Edwards et al, 2019), and better resilience and health-related QoL in people with multiple sclerosis (Nery-Hurwit et al, 2018). In cancer patients, self-compassion was significantly and moderately associated with psychological and social dimensions of QoL (Pinto-Gouveia et al, 2014).

**Self-Compassion and Adherence**

In terms of adherence to both medical and dietary regimens, emerging evidence is increasingly recognising that self-compassion is associated with better medical adherence in people with chronic illnesses such as fibromyalgia, chronic fatigue syndrome, cancer and HIV (Brion et al, 2014). In a study with older adults, individuals who were more self-compassionate were more adherent to medical regimens and more willing to use assistive devices such as mobility and hearing aids, demonstrating that higher-levels of self-compassion may increase ones self-autonomy and willingness to seek help (Allen et al, 2012). Self-compassion may facilitate more adaptive emotional functioning in response to the difficulties bought about by having a chronic condition and increasing self-care behaviours such as taking responsibility for the condition, self-monitoring and emotional regulation (Sirois & Hirsch, 2019). Accordingly, people may feel less depleted by their illness and have more energy towards the self-management of their condition (Terry & Leary, 2011). In CD, given that self-compassion involves mindful acceptance of difficulties and failures, tolerating collateral stress such as lapses in self-care and potential failure of adherence to a gluten free diet may be more manageable with increased self-compassion (Sirois & Rowse, 2016). Furthermore, self-compassion can strengthen resilience for people with CD, by influencing their evaluation of potentially threatening events (Neff, 2003) such as social situations that may involve accidental exposure to gluten or lack of gluten-free choices. However, the avoidance of such situations may reduce overall QoL (Wieser et al, 2021).

Dowd & Jung. (2017) is the only study found to have directly researched the relationship between self-compassion, QoL and adherence to a gluten-free diet. In their study in two hundred North American adults with a diagnosis of CD, they showed self-compassion at baseline directly predicted dietary adherence and better QoL at a 1-month follow-up, indicating self-compassion is an 'important cognition' within this population group. With limited research on the link between self-compassion and CD, it is important to investigate this relationship and factors affecting it further.

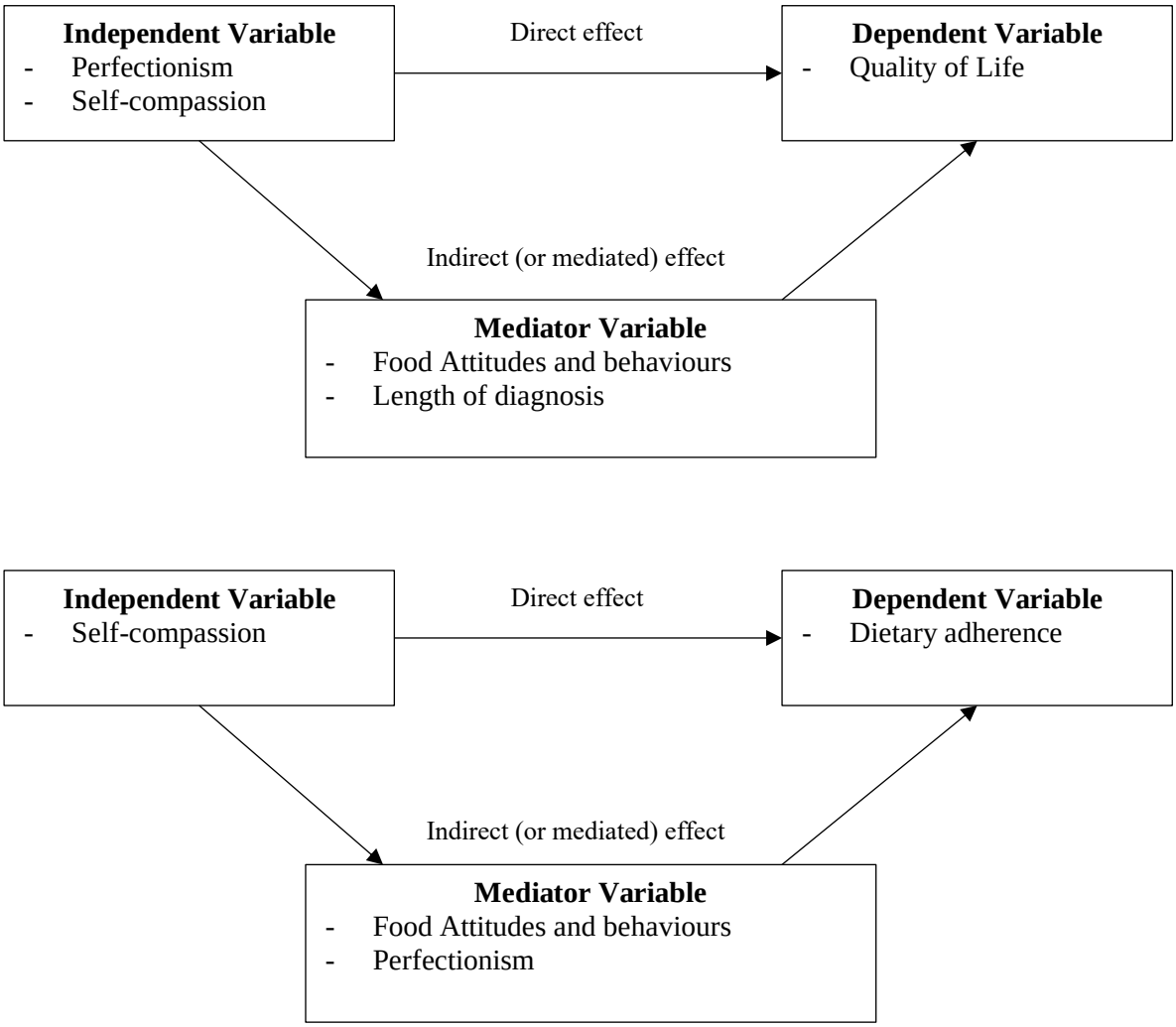
**The Current Study**

It is speculated that the relationship between self-compassion, perfectionism, adherence and QoL may be influenced by the length of diagnosis of CD, and food attitudes and behaviours; those who have been living with the disease for a longer period may develop better coping mechanisms for managing their diet and better food attitudes and behaviours. The independent variables were perfectionism and self-compassion, the dependent variables were dietary adherence and QoL. The mediators for the study were length of diagnosis and food attitudes and behaviours.

Figure 20 represents an example of the considered mediation model. However, as the analysis will be statistically-driven, the mediating variable may vary depending on the significance found within the correlational analysis. The conditions set out by Baron & Kenny (1986) for a mediation analysis will be followed.

**Figure 20**

*Examples of Conceptual Illustration of Predicted Mediation Model with Study Variables*




## Aims and Hypotheses

This will be the first study of its kind to consider the relationship between perfectionism, dietary adherence and QoL in people with CD. Additionally, the study will add to the limited literature in considering the interrelationships between self-compassion, dietary adherence and QoL. It is hoped that the results of this study will provide a better understanding into the psychological factors involved in living with CD and contribute to the development of

targeted psychological interventions to reduce distress, improve self-compassion, and improve QoL in people with CD.

The correlational hypotheses for the study are:

**i.** Interrelationships would exist between perfectionism, self-compassion, dietary adherence, QoL and food attitudes and behaviours.

- **a.** As perfectionism increases, dietary adherence will increase
- **b.** As self-compassion increases, dietary adherence will increase
- **c.** Poorer food attitudes and behaviours will be correlated will lower levels of QoL
- **d.** Poorer food attitudes and behaviours will be correlated will lower levels of dietary adherence

**ii.** Individuals with higher levels of self-compassion are more likely to demonstrate better dietary adherence, to a gluten-free diet

**i.** Individuals with higher levels of perfectionism may exhibit poorer dietary adherence, to a gluten-free diet

**ii.** Individuals with higher levels of self-compassion will experience better QoL

**iii.** Individuals with higher levels of perfectionism will experience poorer QoL

The hypotheses for the mediation analysis are:

**iv.** The relationship between self-compassion, perfectionism and QoL will be mediated by length of diagnosis and food attitudes and behaviours .

**v.** The relationship between self-compassion and dietary adherence will be mediated by length of diagnosis and perfectionism.

## METHOD

### Participants

Participants were recruited via a range of online social media platforms (i.e., Facebook, Instagram, and Twitter). Administrators of the respective CD support groups were contacted and asked to advertise the study. Data were gathered through an online questionnaire pack hosted via Qualtrics (Appendix E-I).

Table 10 outlines the inclusion and exclusion criteria. Individuals who were self-diagnosed, were experiencing symptoms of CD in the absence of a diagnosis, or awaiting a diagnosis were excluded from the study. This is because symptoms of CD can overlap with other gastrointestinal disease, such as Crohn's disease. Due to the online nature of the study, all participants were required to have access to the internet. As existing research has shown common mental health difficulties such as depression and anxiety are prevalent in individuals with CD, anxiety and depression were not part of the exclusion criteria. Table 10 displays both inclusion and exclusion criteria.

**Table 10**

*Study Inclusion and Exclusion Criteria*

| Inclusion Criteria | Exclusion Criteria |
|---|---|
| - Aged over 18 years old.<br>- A diagnosis of CD. Participants were required to self-report that they had either a biopsy diagnosis or blood-test diagnosis, given by a medical professional.<br>- Participants with self-reported anxiety and/or depression/anxiety.<br>- International participants, there were no restrictions on country of residence. | - No internet access.<br>- Currently experiencing symptoms of CD in the absence of a formal diagnosis.<br>- Awaiting a diagnosis of CD.<br>- Self-diagnosis. |

## Design

This study used a cross-sectional, online, questionnaire design using purposive sampling. Data were collected on self-compassion, perfectionism, CD Quality of Life, CD dietary adherence, and CD food attitudes and behaviours. The following demographic details were also collected: age, length of diagnosis, co-morbidities, marital status, education level and country of residence.

## Ethical Approval

This study was approved by The University of Birmingham Science, Technology, Engineering and Mathematical Ethical Review Committee (Appendix A).

## Materials

A summary of the measures used are presented below.

### *Self-compassion*

Self-compassion was measured using the Self-Compassion Scale (SCS; Neff, 2003). The SCS is a 26-item scale assessing six constructs: self-kindness, self-judgement (reverse scored), common humanity, isolation (reverse scored), mindfulness and over-identification (reverse scored). Participants are asked to think about a situation that they are currently experiencing which is painful or distressing to them and select the rating of statements that best apply to them. Items are rated on a 5-point Likert Scale from 1 (Almost Never) to 5 (Almost Always) and indicate how well the statements mentioned apply to them. The potential total scores range from 26-130. The SCS has good published overall internal reliability (Cronbach's $\alpha$=0.92) and subscale reliabilities (Cronbach's $\alpha$ ranging from 0.75 to 0.81), as well as overall test-retest reliability (over a three-week interval). Higher scores for total and subscales indicate

higher levels of self-compassion. Reliability for the current empirical study was calculated to be α=0.94.

***Perfectionism***

Perfectionism was measured using the 35-item Frost Multidimensional Perfectionism Scale (Frost et al, 1990; Hewitt et al, 1991) which includes five subscales: concerns over mistakes, parental expectations, excessively high personal standards, concern with precision, order and organisation. Items are scored on a Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) and has good published internal consistency (Cronbach's α=0.87) (Woodfin et al, 2020) and subscale reliabilities (Cronbach's α ranging from 0.66 to 0.87). The range of possible total scores is 35-175 with higher scores indicative of higher levels of perfectionism; scores above the 90$^{th}$ percentile represent dysfunctional perfectionism. Reliability for the current empirical study was calculated to be α=0.94.

***Quality of Life***

Quality of Life was measured using The CD Quality of Life Survey (CD-QOL), a CD specific instrument by Dorn et al. (2010). The subscales on the 20-item measure include stigma and mood, health concerns, perceptions of treatment, and functional impact. Items are scored on a Likert Scale from 1 (not at all) to 5 (a great deal), which asks participants to think about their life over the past 30 days and select the rating of statements that best describes how they feel. The highest possible score is 100 and the lowest is 20. The CD-QOL total and subscales scores have acceptable internal consistency reliability (Cronbach's α=0.8), (Dochat et al, 2023). Higher scores indicate a lower CD specific QoL in subscales and overall scores. Reliability for the current empirical study was calculated to be α=0.93.

### *Dietary Adherence*

The Celiac Dietary Adherence Test (CDAT) (Leffler et al, 2009), is a 7-item instrument that measures adherence to a gluten-free diet. The measure asks participants varying questions about dietary management and participants select options on a 5-point Likert scale. Examples of questions include “Have you been bothered by low energy level during the past 4 weeks?”, with responses of None of the time (1) to All the time (5), other questions ask to what extent participants agree “Before I do something I carefully consider the consequences”, the scale is Strongly Agree (1) to Strongly disagree (5). There are no subscales for this measure. The lowest possible score is 7 and the highest is 35, with higher scores denoting worse adherence to a gluten-free diet. Scores of less than 13 indicate excellent or very good gluten-free diet adherence, scores between 14 and 16 indicate average adherence and scores greater than 17 indicate fair to poor adherence. The measure has acceptable published internal consistency (Cronbach's $\alpha$=0.72) (Johansson et al, 2019). Reliability for the current empirical study was calculated to be $\alpha$=0.58.

### *Food Attitudes and Behaviours*

The CD Food Attitudes and Behaviours Scale (CD-FAB) (Satherley et al, 2018), is a disease-specific 13-item scale which measures food attitudes and behaviours. The measure is a 7-point Likert scale ranging from Strongly Agree (7) to Strongly Disagree (1) that begins with “Because of my Coeliac Disease…” following by a list of statements. The lowest possible score is 13 and the highest is 91. The themes looked at in the CD-FAB are underlying food attitudes, concerns, and eating behaviours, for example the handling of food, trust, risk-taking, and food safety. Higher scores indicate individuals feel more socially limited and concerned about the disease and its health consequences compared to low scorers, thus indicating impaired psychosocial well-being. The published Cronbach's alpha for the overall

scale was high (α=0.89) and with excellent test-retest reliability over 4 weeks. Reliability for the current empirical study was calculated to be α=0.83.

**Procedure**

Participants could view the study advertisement accompanied by a Qualtrics survey link on various social media platforms. Qualtrics is an operating system for survey data collection. The online survey was open from 6th July 2022 to 31st March 2023. Upon clicking the link to the survey, participants were taken to the first stage of the study, an information screen outlining details of the study (Appendix B). Participants were informed their data would remain confidential and responses would be entirely anonymous and they were asked to consent to the study.

Participants were informed that they were free to withdraw at any point during completion of the survey, however they were not able to withdraw their data once the survey had been submitted as no identifiable information was collected.

Participants were then presented with a screening questionnaire to confirm a diagnosis of CD had been received through either a blood test or biopsy. Participants who had not been given a diagnosis through a blood test or biopsy were not able to proceed with remainder of the study.

Following on from the screening stage, eligible participants were asked demographic information: age, gender, ethnicity, highest education level, employment status, marital status, other pre-existing, residing country and length of diagnosis. Participants were then presented with the measures.

At the end of the study participants were shown a debrief page (Appendix C). This screen displayed the researchers contact details should participants have any questions, queries,

or concerns about the study. Participants were advised to contact their GP should they have any medical related concerns or required any support in relation to their condition.

**Data Analysis**

All data were exported from Qualtrics to Excel, to screen and code the data. Following this, data was exported into and analysed using IBM SPSS Version 29. The demographic information was analysed using descriptive and frequency techniques within SPSS. The data was then assessed for normality using Kolmogorov-Smirnov, this is a prerequisite for statistical testing to identify if the data met the assumptions for parametric testing. Pearson's correlation coefficient was used to test the strength of the linear association between the study variables followed by a multiple linear regression to establish that a mediation analysis was possible. This was used to test if self-compassion, perfectionism, food attitudes and behaviours and length of diagnosis significantly predicted adherence to a gluten-free diet and QoL (dependent variables). Finally, a mediation analysis was conducted to determine the impact of potential mediators. A sample size of 80 was the minimum required to detect statistically significant results ($p<0.05$) with power set at 0.80 (Cohen, 1992).

# RESULTS

## Response Rates

A total of 458 participants took part and provided complete datasets. This exceeded the minimum sample size required, providing power for the detection of smaller effects. There were 121 participants with incomplete datasets, some had completed the demographic section of the survey and then did not continue with questionnaire completion or discontinued at various stages whilst completing the measures. Therefore, those responses were excluded from the survey.

## Participant Demographics

All participants who participated in the study had a self-reported formal diagnosis of CD. The majority of the sample (94.8%) were female (n=434), 3.9% were male (n=18) and 1.3% were non-binary (n=6). The age of participants ranged from 18 to 77 years, with an average age of 36.2 (S.D.=11.4); 80% of participants were under the age of 44 and 50% under the age of 33. The age of diagnosis of participants (Table 11) varied from under the age of one to 65 years old (M=36.14, SD=28.92). The length of diagnosis for this participant group (Table 11) varied from less than one year to 57.5 years since being diagnosed (M=18.54, SD=20.61).

**Table 11**

*Table Displaying Age of Participant Diagnosis and Length of Diagnosis*

| Age of diagnosis | Number of participants | Age of diagnosis | Number of participants |
|---|---|---|---|
| <1yrs | 4 | 31-35yrs | 61 |
| 1-5yrs | 23 | 35-40yrs | 32 |
| 6-10yrs | 12 | 40-45yrs | 35 |
| 11-15yrs | 24 | 46-50yrs | 18 |
| 16-20yrs | 73 | 51-55yrs | 9 |
| 21-25yrs | 84 | 56-60yrs | 11 |
| 26-30yrs | 68 | 61-65yrs | 4 |
| **Length of diagnosis (In years)** | **Number of participants** | **Length of diagnosis (In years)** | **Number of participants** |
| >1 | 24 | 19 | 4 |
| 1 | 58 | 20 | 10 |
| 2 | 43 | 21 | 6 |
| 3 | 38 | 22 | 4 |
| 4 | 31 | 23 | 5 |
| 5 | 24 | 24 | 1 |
| 6 | 24 | 25 | 3 |
| 7 | 22 | 26 | 4 |
| 8 | 15 | 27 | 1 |
| 9 | 17 | 28 | 2 |
| 10 | 18 | 29 | 3 |
| 11 | 18 | 30.5 | 3 |
| 12 | 9 | 33 | 1 |
| 13 | 9 | 35 | 2 |
| 14 | 14 | 38 | 1 |
| 15.5 | 7 | 44 | 1 |
| 16 | 11 | 46 | 1 |
| 17.5 | 10 | 51 | 1 |
| 18 | 12 | 57.5 | 1 |

In terms of ethnicity, 93.9% were White (n=430), 3.5% were of Asian background, 1.3% (n=16) were from a mixed or multiple ethnic group background, 0.4% (n=6) were from other backgrounds, (n=4), and 0.4% (n=2) preferred not to state their ethnicity. There were 200 participants (43.7%) who had a diagnosis of one or more medical conditions in addition to CD; a total of 100 conditions were reported by those participants, a full list can be found in Appendix D. The most common comorbid conditions were asthma (n=25), hypothyroidism (n=17), anxiety (n=16), severe allergies (n=14), depression (n=14) and Hashimoto's (n=13). A range of other demographic details were collected (i.e., education level, employment status, marital status, country of results) and are presented in Table 12.

**Table 12**

*Participant Demographic Information*

| **Demographics** | | **N** | **%** |
|---|---|---|---|
| Highest Education Level | Undergraduate/Bachelor's Degree | 195 | 42.6 |
| | Postgraduate Master's degree | 128 | 27.9 |
| | Secondary school | 59 | 12.9 |
| | Trade/Technical/Vocational training | 50 | 10.9 |
| | Doctorate Degree | 13 | 2.8 |
| | Other | 12 | 2.6 |
| | Masters | 1 | 0.2 |
| Employment Status | Employed | 338 | 73.8 |
| | Student | 36 | 7.8 |
| | Self-employed | 27 | 5.9 |
| | A homemaker | 17 | 3.7 |
| | Retired | 13 | 2.8 |
| | Unable to work | 11 | 2.4 |
| | Out of work and looking for work | 5 | 1.1 |
| | Out of work but not currently looking for work | 4 | 0.9 |
| | Other | 7 | 1.5 |
| Marital Status | Married | 224 | 48.9 |
| | Long-term relationship | 105 | 22.9 |
| | Single, never married | 101 | 22.1 |
| | Divorced | 23 | 5.0 |
| | Widowed | 3 | 0.7 |
| | Separated | 2 | 0.4 |
| Country Of Residence | Australia | 194 | 42.4 |
| | United Kingdom | 184 | 40.2 |
| | USA | 22 | 4.8 |
| | New Zealand | 14 | 3.1 |
| | Ireland | 10 | 2.2 |
| | Malta | 5 | 1.1 |
| | Canada | 5 | 1.1 |
| | India | 3 | 0.7 |
| | Netherlands | 2 | 0.4 |
| | South Africa | 2 | 0.4 |
| | Sweden | 2 | 0.4 |
| | Switzerland | 2 | 0.4 |
| | UEA | 2 | 0.4 |
| | Iceland | 1 | 0.2 |
| | Germany | 1 | 0.2 |
| | France | 1 | 0.2 |
| | Ecuador | 1 | 0.2 |
| | Belgium | 1 | 0.2 |
| | Mexico | 1 | 0.2 |
| | Norway | 1 | 0.2 |
| | Portugal | 1 | 0.2 |
| | Slovakia | 1 | 0.2 |
| | Spain | 1 | 0.2 |
| | Italy | 1 | 0.2 |

**Descriptive Statistics for all Measures**

Table 13 displays descriptive statistics including means and standard deviations for the five measures used. The minimum and maximum scores achieved from the sample are also shown with the lowest and highest possible scores displayed in brackets. A breadth of scores were reported in each of the measures. Overall, participants scored within the average range in all measures except the CDAT. The average CDAT scores reported in this sample group indicate moderate adherence, slightly below the measure average.

**Table 13**

*Descriptive Statistics For Study Measures*

| Measure | Minimum Scores (Lowest and highest possible scores) | Maximum Scores (Lowest and highest possible scores) | Mean | Standard Deviation |
|---|---|---|---|---|
| SCS | 34 (26) | 123 (130) | 70.83 | 17.46 |
| CD-FAB | 15 (13) | 85 (91) | 49.59 | 13.82 |
| CDAT | 7 (7) | 35 (35) | 13.26 | 3.68 |
| QoL | 20 (20) | 100 (100) | 58.19 | 16.81 |
| FMPS | 35 (35) | 175 (175) | 106.49 | 22.03 |

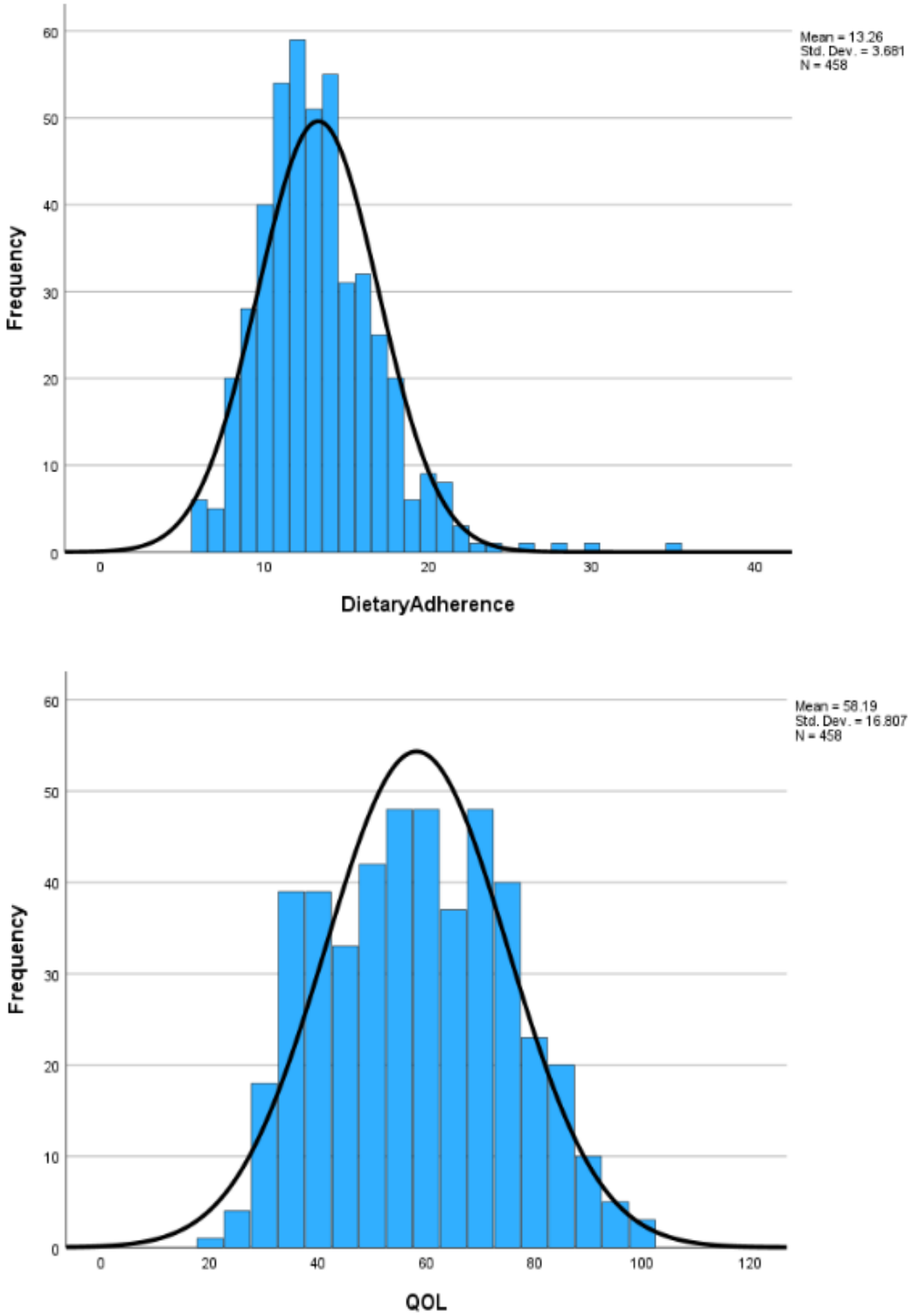
**SCS= Self-Compassion Scale; FMPS= Frost Multidimensional Perfectionism Scale; QoL= The CD Quality of Life survey; CDAT= The Celiac Dietary Adherence Test; CD-FAB=The CD Food Attitudes and Behaviours Scale.*

**Distribution of the Dependent Variables**

The distribution of dietary adherence (M=13.26, SD=3.68) and QoL (M=58.19, SD=16.81) shown in Figure 21 do not deviate from normal expectations. Similarly, there is no substantive difference between the mean and the median values for the dependent variables. Accordingly, dietary adherence and QoL are suitable for parametric analysis.

**Figure 21**

*Histogram Displaying Distribution for the Two Dependent Variables*



**Correlations: Hypothesis 1**

Pearson's correlation coefficient was used to assess the strength of the linear association between the study variables, results are presented in Table 14.

**Table 14**

*Table Displaying Correlation Analysis Between All Study Variables*

| | | Age | Age Of Diagnosis | Length Of Diagnosis | Self-Compassion | Food Attitudes | Dietary Adherence | QOL | Perfectionism |
|---|---|---|---|---|---|---|---|---|---|
| Age | Pearson's C | - | 0.766** | 0.177** | 0.201** | -0.072 | -0.091 | -0.093* | -0.153** |
| | Sig. (2-tailed) | - | **< 0.001** | **< 0.001** | **< 0.001** | 0.124 | **0.052** | **0.047** | **0.001** |
| Age Of Diagnosis | Pearson C | 0.766** | - | -0.496** | 0.133** | 0.095* | -0.055 | 0.123** | -0.090 |
| | Sig. (2-tailed) | **< 0.001** | - | **< 0.001** | **0.004** | **0.041** | 0.240 | **0.009** | 0.055 |
| Length Of Diagnosis | Pearson C | 0.177** | -0.496** | - | 0.065 | -0.246** | -0.039 | -0.314** | -0.068 |
| | Sig. (2-tailed) | **< 0.001** | **< 0.001** | - | 0.165 | **< 0.001** | 0.407 | **< 0.001** | 0.148 |
| Self-Compassion | Pearson C | 0.201** | 0.133** | 0.065 | - | -0.303** | -0.364** | -0.292** | -0.446** |
| | Sig. (2-tailed) | **< 0.001** | **0.004** | **0.165** | - | **< 0.001** | **< 0.001** | **< 0.001** | **< 0.001** |
| Food Attitudes | Pearson C | -0.072 | 0.095* | -0.246** | -0.303** | - | 0.177** | 0.707** | 0.290** |
| | Sig. (2-tailed) | 0.124 | **0.041** | **< 0.001** | **< 0.001** | - | **< 0.001** | **< 0.001** | **< 0.001** |
| Dietary Adherence | Pearson C | -0.091 | -0.055 | -0.039 | -0.364** | 0.177** | - | 0.365** | 0.220** |
| | Sig. (2-tailed) | **0.052** | 0.240 | 0.407 | **< 0.001** | **< 0.001** | - | **< 0.001** | **< 0.001** |
| QoL | Pearson C | -0.093* | 0.123** | -0.314** | -0.292** | 0.707** | 0.365** | - | 0.295** |
| | Sig. (2-tailed) | **0.047** | **0.009** | **< 0.001** | **< 0.001** | **< 0.001** | **< 0.001** | - | **< 0.001** |
| Perfectio-nism | Pearson C | -0.153** | -0.090 | -0.068 | -0.446** | 0.290** | 0.220** | 0.295** | - |
| | Sig. (2-tailed) | **0.001** | 0.055 | 0.148 | **< 0.001** | **< 0.001** | **< 0.001** | **< 0.001** | - |

*Significant results are highlighted in bold.*
***. Correlation is significant at the 0.01 level (2-tailed).*
**. Correlation is significant at the 0.05 level (2-tailed).*

***Relationships with Perfectionism***

There was a significant medium negative correlation between perfectionism and self-compassion (r = -.446, p <.001), a small significant positive correlation between perfectionism and food attitudes and behaviours (r =.290 p <.001), between perfectionism and dietary adherence (r = .220, p <.001), and between perfectionism and QoL (r = .295, p <.001). A small

negative correlation was found between perfectionism and age (r = -.153, p <.001). These results show that as levels of perfectionism increase, self-compassion decreases, and adherence to a gluten-free diet also decreases. Additionally, as perfectionism increases, people report lower levels of QoL and people's food attitudes and behaviours worsen meaning they feel more limited by the condition. There was no significant association between perfectionism, length of diagnosis (r = -.068, p = .148) and age of diagnosis (r = -.090, p = 0.06).

***Relationships with Self-Compassion***

In terms of self-compassion, there was a significant negative medium association with food attitudes and behaviours (r = -.303, p <.001) and dietary adherence (r = -.364, p <.001), and a small negative association with QoL (r = -.292, p <.001), a small positive association with age (r = .201, p <.001) and age of diagnosis (r =.133, p <.001). This shows that as self-compassion increases people report a higher QoL, their food attitudes and behaviours improve, and self-compassion appears to improve with age. Additionally, with increased self-compassion, adherence to a gluten-free diet improves. There was no significant association between self-compassion and length of diagnosis (r = .065, p = .165).

***Correlations Between Dependent Variables, Mediating Variables, and Demographics***

Analysis showed that there was a large correlation between food attitudes and behaviours and QoL (r = .707, p <.001), meaning that as people feel more limited by the disease, QoL decreases. QoL was also negatively associated with length of diagnosis (r = -.314, p<.001), indicating that as the duration of CD increases, QoL improves. QoL is also associated with dietary adherence (r = .365, p <.001), as QoL worsens so does adherence to a gluten-free diet.

A small negative association between length of diagnosis and food attitudes and behaviours was also found (r=-.246, p<.001), as the duration of diagnosis increases, indicating people feel less limited from having CD.

**Prediction of Dietary Adherence: Hypothesis 2**

As observed in Table 10 above, the Pearson's zero order correlation coefficients indicates that, Age (r = -.091, p = 052), Self-Compassion (r = -.364, p <0.001), Food attitudes and Behaviours (r = .177, p <0.001), and Perfectionism (r = .220, p <0.001) showed significant zero order pairwise correlations with dietary adherence. To assess the unique contribution of each of these variables they were entered into a regression analysis.

***Regression Analysis***

Multiple linear regression was used to examine the effects age, self-compassion, perfectionism and food attitudes and behaviours had on the dependent variable, adherence to a gluten-free diet (Table 15).

**Table 15**

*Regression Analysis for Dietary Adherence*

| | SS | df | F | p | $\eta^2p$ |
|---|---|---|---|---|---|
| Model | 868.15 | 4 | 18.4655 | **< .001** | 0.140 |
| Age | 1.13 | 1 | 0.0965 | 0.756 | 0.000 |
| Self-Compassion | 463.07 | 1 | 39.3977 | **< .001** | 0.080 |
| Perfectionism | 16.43 | 1 | 1.3975 | 0.238 | 0.003 |
| Food Attitudes and Behaviours | 22.10 | 1 | 1.8806 | 0.171 | 0.004 |

**Significant results are highlighted in bold.*

The regression model accounted for 13.3% of the variance in dietary adherence and the only significant predictor was self-compassion. Self-compassion was then removed from the regression model to assess the impact on the other covariates. It was observed that when self-compassion was removed from the regression model perfectionism ($F = 13.52$, $p < 0.001$) and food attitudes ($F = 6.64$, $p = 0.01$) become statistically significant, suggesting that these variables share common variance with the relationship between self-compassion and dietary adherence. A mediation analysis was therefore conducted to assess whether perfectionism and food attitudes and behaviours mediate the relationship between self-compassion and dietary adherence.

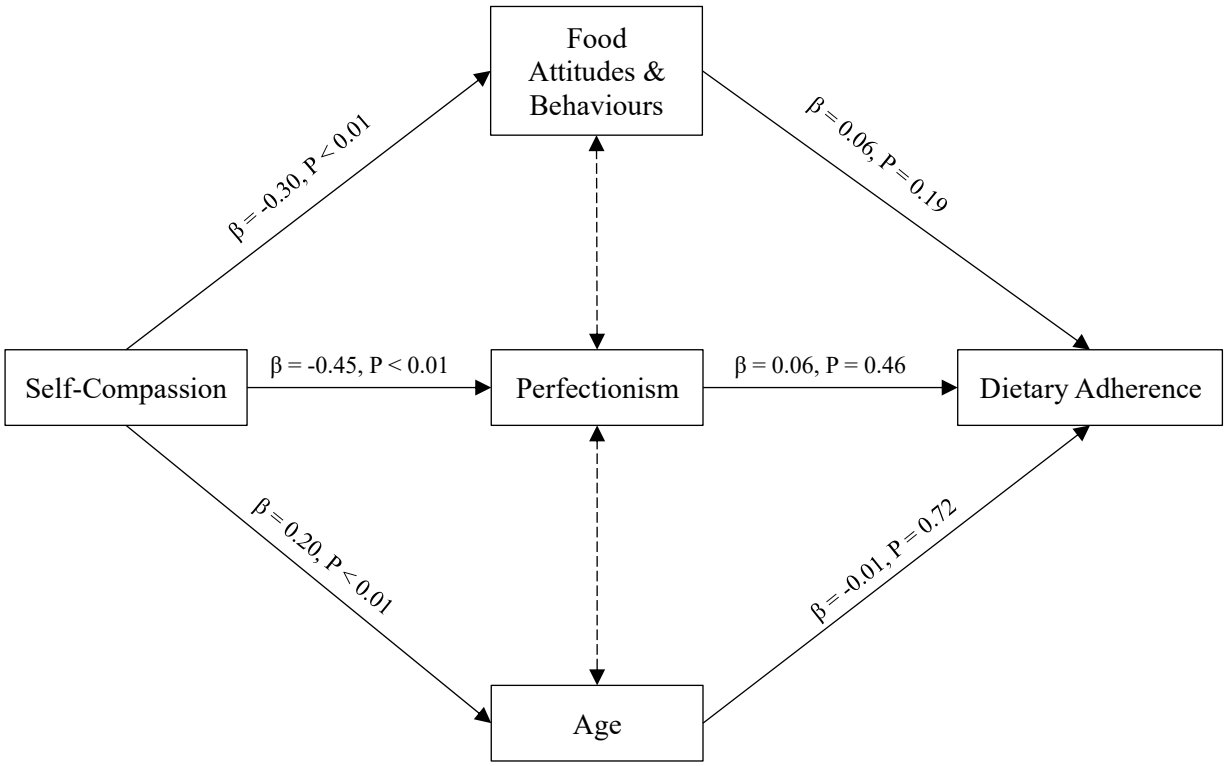
***Mediation Analysis: Hypotheses 3***

To conduct the analysis the Medmod mediation package and the Lavaan latent variable analysis package within the Jamovi statistical application (Şahin & Aybek, 2020) was used. This allows for the fitting of models with multiple mediators using generalised linear regression to fit latent variable models and uses the non-parametric bootstrap to calculate parameter estimates, confidence intervals and significance levels. Partial mediation requires that the indirect pathway is statistically significant and the two component pathways (from which the indirect effect is derived) are also statistically significant. Full mediation has the additional requirement that the direct effect drops to near zero in the mediated model.

The conceptual illustration shown in Figure 22 depicts a mediation model and pathways between self-compassion and dietary adherence, along with the mediating roles of food attitudes and behaviours, perfectionism, and age.

**Figure 22**

*Mediation Model of the relationship between self-compassion and dietary adherence*




The mediation analysis Table 16 revealed the total effect of self-compassion on adherence was significant (β = -0.36370, 95% CI [-0.09468, -0.05867], z = -8.347, p < .001), which is consistent with the previous bivariate and regression analyses. With the inclusion of the three proposed mediating variables, the direct effect of self-compassion on adherence remained significant (β = -0.31543, 95% CI [-0.08981, -0.04475], z = -5.690, p < .001). The indirect effects of self-compassion through the mediating variables of age (β = -0.00279, 95% CI [-0.00387, 0.00278], z = -0.349, p = 0.727), perfectionism (β = -0.02616, 95% CI [-0.02080, 0.00795], z = -0.736, p = 0.462) and food attitudes and behaviours (β = -0.01932, 95% CI [-0.01084, 0.00195], z = -1.277, p = 0.201) were found to be non-significant. Therefore, the relationship between self-compassion and adherence is not mediated by age, perfectionism and food attitudes and behaviours. Significance was observed between self-compassion and perfectionism (β = -0.44594, 95% CI [-0.66315, -0.46169], z = -11.046, p < .001) and self-

compassion and food attitudes and behaviours (β = -0.30299, 95% CI [-0.30579, -0.17347], z = -7.005, p < .001). Therefore, this shows associations are present between self-compassion and perfectionism and also self-compassion and food attitudes and behaviours, however both perfectionism and food attitudes do not impact the relationship between self-compassion and dietary adherence.

**Table 16**

*Indirect and Total Effects of the Mediation Model*

| Type | Effect | Estimate | SE | 95% C.I. (a) Lower | 95% C.I. (a) Upper | β | z | p |
|---|---|---|---|---|---|---|---|---|
| Indirect | Self-Compassion ⇒ Age ⇒ Dietary Adherence | -0.000587 | 0.00168 | -0.00387 | 0.00278 | -0.00279 | -0.349 | 0.727 |
| | Self-Compassion ⇒ Perfectionism ⇒ Dietary Adherence | -0.00552 | 0.00750 | -0.02080 | 0.00795 | -0.02616 | -0.736 | 0.462 |
| | Self-Compassion ⇒ Food Attitudes ⇒ Dietary Adherence | -0.00407 | 0.00319 | -0.01084 | 0.00195 | -0.01932 | -1.277 | 0.201 |
| Component | Self-Compassion ⇒ Age | 0.13128 | 0.03179 | 0.07192 | 0.19908 | 0.20105 | 4.129 | **< .001** |
| | Age ⇒ Dietary Adherence | -0.00447 | 0.01263 | -0.02860 | 0.02064 | -0.01385 | -0.354 | 0.723 |
| | Self-Compassion ⇒ Perfectionism | -0.56263 | 0.05093 | -0.66315 | -0.46169 | -0.44594 | -11.046 | **< .001** |
| | Perfectionism ⇒ Dietary Adherence | 0.00980 | 0.01337 | -0.01425 | 0.03717 | 0.05867 | 0.733 | 0.463 |
| | Self-Compassion ⇒ Food Attitudes | -0.23980 | 0.03423 | -0.30579 | -0.17347 | -0.30299 | -7.005 | **< .001** |
| | Food Attitudes ⇒ Dietary Adherence | 0.01698 | 0.01293 | -0.00795 | 0.04317 | 0.06376 | 1.314 | 0.189 |
| Direct | Self-Compassion ⇒ Dietary Adherence | -0.06650 | 0.01169 | -0.08981 | -0.04475 | -0.31543 | -5.690 | **< .001** |
| Total | Self-Compassion ⇒ Dietary Adherence | -0.07668 | 0.00919 | -0.09468 | -0.05867 | -0.36370 | -8.347 | **< .001** |

**Significant results are highlighted in bold.*
*Confidence intervals computed with method: Bootstrap percentiles. Betas are completely standardized effect sizes.*

**Prediction of Quality of Life**

As can be seen from Table 14 , the Pearson's zero order correlation coefficients showed that age (r =-.093, p=.047), age of diagnosis (r=.123, p=.009), length of diagnosis (r=-.314, p<.001), self-compassion (r=-.292, p<.001), perfectionism (r=.295, p<.001), food attitudes and behaviours (r=.707, p<.001), dietary adherence (r=.365, p<.001), have significant pair-wise relationships with Quality of Life. Accordingly, these variables were entered into a regression analysis to estimate their combined effect and assess potential covariation amongst these predictors.

***Regression Analysis: Hypotheses 4***

Multiple linear regression was used to examine the effects that all the significant variables had on the dependent variables, QoL.

**Table 17**

*Regression Analysis for QoL*

| Predictor | Estimate | SE | t | p |
|---|---|---|---|---|
| **Intercept** | 2.0988 | 5.6193 | 0.374 | 0.709 |
| **Food Attitudes & Behaviours** | 0.7484 | 0.0408 | 18.327 | **< .001** |
| **Perfectionism** | 0.0474 | 0.0265 | 1.788 | 0.075 |
| **Dietary Adherence** | 1.1142 | 0.1499 | 7.433 | **< .001** |
| **Self-Compassion** | 0.0192 | 0.0353 | 0.544 | 0.587 |
| **Length Of Diagnosis (Years)** | 0.3580 | 1.0024 | 0.357 | 0.721 |
| **Age Of Diagnosis** | 0.6589 | 0.9979 | 0.660 | 0.509 |
| **Age** | -0.6494 | 0.9983 | -0.651 | 0.516 |

**Significant results are highlighted in bold.*

The regression model accounted for 58.3% of the variation in QoL and indicated that food attitudes and behaviours (t=18.327, p<.001) and dietary adherence (t=7.433, p< .001) were significantly associated with Quality of Life (Table 18). When these two variables were

removed from the regression then perfectionism (t=4.127, p<.001) and self-compassion (t=-4.062, p< .001) become significantly associated with QoL (Table 18).

**Table 18**

*Regression Analysis for QoL with Food Attitudes and Dietary Adherence Removed*

| Predictor | Estimate | SE | t | p |
|---|---|---|---|---|
| **Intercept** | 59.137 | 6.3748 | 9.277 | < .001 |
| **Length Of Diagnosis (Years)** | -1.223 | 1.3781 | -0.888 | 0.375 |
| **Age Of Diagnosis** | -0.636 | 1.3734 | -0.463 | 0.643 |
| **Age** | 0.676 | 1.3738 | 0.492 | 0.623 |
| **Self-Compassion** | -0.186 | 0.0457 | -4.062 | **< .001** |
| **Perfectionism** | 0.148 | 0.0359 | 4.127 | **< .001** |

**Significant results are highlighted in bold.*

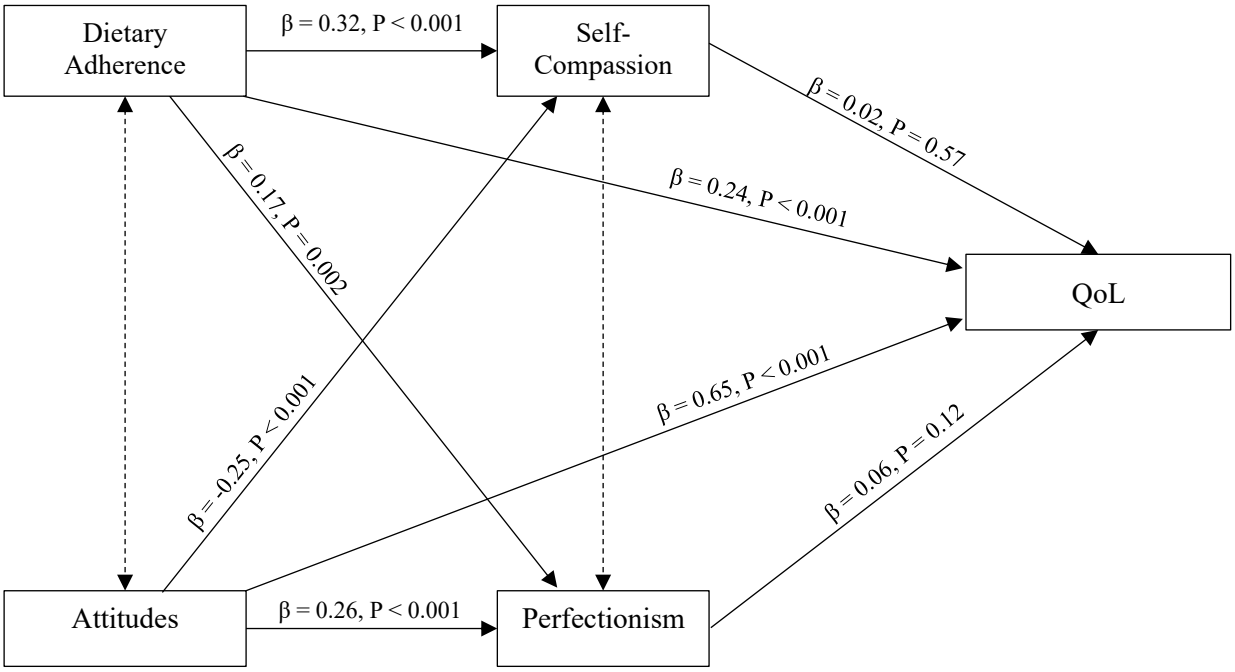
This introduces the possibility of a mediation model in which the direct effects of food attitudes and behaviours and dietary adherence may be mediated through self-compassion and perfectionism.

### *Mediation Analysis: Hypotheses 5*

The conceptual illustration shown in Figure 23 depicts a mediation model and pathways between food attitudes and behaviours and dietary adherence, along with the mediating roles of self-compassion and perfectionism on QoL.

**Figure 23**

*Mediation Analysis on QoL*




With respect to the relationship between food attitudes and Quality of Life, the mediation analysis (Table 19) revealed that the total effect of food attitudes and behaviours on QoL was statistically significant *(*β = 0.66267, 95% CI [0.73067, 0.8813], z = 20.979, *p* < 0.001. With the inclusion of the three proposed mediating variables, the direct effect of food attitudes on QoL remained significant *(*β = 0.65181, 95% CI [0.71515, 0.8709], z = 20.527, *p* < .001). The indirect effects of food attitudes through the mediating variables of perfectionism (β = 0.01612, 95% CI [-0.00598, 0.0452], z = 1.533, *p* = 0.125), and self-compassion (β = -0.00527, 95% CI [-0.02868, 0.0171], z = -0.563, p = 0.574) were found to be non-significant. Therefore, the relationship between food attitudes and QoL is not mediated by the three proposed variables. There were two component links that were significant within the mediation model, between food attitudes and perfectionism (β = 0.25962, 95% CI [0.27063, 0.5529], z = 5.796, *p* < .001), and food attitudes and self-compassion perfectionism (β = -0.24623, 95% CI [-0.41986, -0.2100], z =-5.933, *p* < .001).

With respect to the relationship between dietary adherence and Quality of Life, the mediation analysis (Table 19) revealed that the total effect of adherence on QoL was statistically significant (β = 0.24726, 95% CI [0.84628, 1.4116], z = 7.828, p < .001). With the inclusion of the three proposed mediating variables, the direct effect of adherence on QoL remained significant (β = 0.24331, 95% CI [0.74706, 1.4265], z = 6.320, *p* < .001). The indirect effects of adherence through the mediating variables of perfectionism (β = 0.01080, 95% CI [-0.01143, 0.1382], z =1.243, p = 0.214) and self-compassion (β = -0.00684, 95% CI [-0.14561, 0.0891], z = -0.554, p = 0.579) were found to be non-significant. Therefore, the relationship between dietary adherence and QoL is not mediated by the three proposed variables. There were two component links that were significant within the mediation model: between dietary adherence and perfectionism (β = 0.17392, 95% CI [0.40538, 1.7408], z = 3.033, p = 0.002) and between adherence and self-compassion (β = -0.32002, 95% CI [-2.02263, -1.0793], z = -6.439, p < .001). Meaning, associations are present between dietary adherence and perfectionism and dietary adherence and self-compassion.

**Table 19**

*Indirect and Total Effects on QoL*

| Type | Effect | Estimate | SE | 95% C.I. (a) Lower | 95% C.I. (a) Upper | β | z | p |
|---|---|---|---|---|---|---|---|---|
| **Indirect** | Attitudes ⇒ Perfectionism ⇒ QoL | 0.01960 | 0.0128 | -0.00598 | 0.0452 | 0.01612 | 1.533 | 0.125 |
| | Attitudes ⇒ Self-Compassion ⇒ QoL | -0.00640 | 0.0114 | -0.02868 | 0.0171 | -0.00527 | -0.563 | 0.574 |
| | Adherence ⇒ Perfectionism ⇒ QoL | 0.04930 | 0.0397 | -0.01143 | 0.1382 | 0.01080 | 1.243 | 0.214 |
| | Adherence ⇒ Self-Compassion ⇒ QoL | -0.03125 | 0.0564 | -0.14561 | 0.0891 | -0.00684 | -0.554 | 0.579 |
| **Component** | Attitudes ⇒ Perfectionism | 0.41388 | 0.0714 | 0.27063 | 0.5529 | 0.25962 | 5.796 | **< 0.001** |
| | Perfectionism ⇒ QoL | 0.04737 | 0.0308 | -0.01446 | 0.1093 | 0.06208 | 1.536 | 0.124 |
| | Attitude ⇒ Self-Compassion | -0.31112 | 0.0524 | -0.41986 | -0.2100 | -0.24623 | -5.933 | **< 0.001** |
| | Self-Compassion ⇒ QoL | 0.02058 | 0.0362 | -0.04950 | 0.0919 | 0.02138 | 0.568 | 0.570 |
| | Adherence ⇒ Perfectionism | 1.04080 | 0.3431 | 0.40538 | 1.7408 | 0.17392 | 3.033 | **0.002** |
| | Adherence ⇒ Self-Compassion | -1.51795 | 0.2357 | -2.02263 | -1.0793 | -0.32002 | -6.439 | **< 0.001** |
| **Direct** | Attitudes ⇒ QoL | 0.79276 | 0.0386 | 0.71515 | 0.8709 | 0.65181 | 20.527 | **< 0.001** |
| | Adherence ⇒ QoL | 1.11088 | 0.1758 | 0.74706 | 1.4265 | 0.24331 | 6.320 | **< 0.001** |
| **Total** | Attitudes ⇒ QoL | 0.80596 | 0.0384 | 0.73067 | 0.8813 | 0.66267 | 20.979 | **< 0.001** |
| | Adherence ⇒ QoL | 1.12894 | 0.1442 | 0.84628 | 1.4116 | 0.24726 | 7.828 | **< 0.001** |

**Significant results are highlighted in bold.*
*Confidence intervals computed with method: Bootstrap percentiles. Betas are completely standardized effect sizes.*

# DISCUSSION

This study was the first of its kind to investigate the relationship that self-compassion and perfectionism may have on QoL and adherence to a gluten-free diet, in people with CD. The potential role of food attitudes and behaviours as a mediating variable was also investigated. The study was undertaken as previous literature has suggested that psychological factors such as self-compassion may contribute to the QoL and self-management regimens such as dietary adherence in people with CD (Dowd & Jung, 2017) and other chronic conditions (Sirois & Hirsch, 2019). Prior research of other chronic health conditions has indicated that perfectionism has an influence on QoL (Rutter-Eley et al, 2020), yet this relationship has not previously been investigated in people with CD. Food attitudes and behaviours was chosen as a potential mediating variable as it has been found that poor relationships with food can influence QoL in people with CD (Lee et al, 2021). Therefore, the hypotheses of the study were; (i) interrelationships would exist between: perfectionism, self-compassion, dietary adherence, QoL and food attitudes and behaviours, (ii) self-compassion, perfectionism and food attitudes and behaviours may be predictors for dietary adherence, (iii) self-compassion and perfectionism may be predictors for QoL, (iv) the relationship between self-compassion, perfectionism and dietary adherence may be mediated by food attitudes and behaviours, (v) the relationship between self-compassion, perfectionism and QoL may be mediated by food attitudes and behaviours.

## Discussion of Results: Dietary Adherence

This study measured the cross-sectional relationship between self-compassion, perfectionism, dietary adherence, food attitudes and behaviours, and QoL. The correlation analysis showed that with increased age, dietary adherence improves. However, there were no significant associations between age of diagnosis and duration of diagnosis with dietary

adherence. The findings add to the inconsistencies in literature, some studies have also reported no associations (Leffler et al, 2008; Viljamaa et al, 2005), some reported lower dietary adherence in those who were diagnosed when younger (Ciacci et al, 2003) and higher adherence in those diagnosed later in life (Hankey et al, 1994). It was also found that as food attitudes and behaviours worsen, dietary adherence reduces, as levels of perfectionism increase, dietary adherence is poorer and as self-compassion increases dietary adherence improves. It was hypothesised that as levels of perfectionism increase, adherence to a gluten-free diet would improve, however the current study found the opposite. Although current research looking at perfectionism and dietary adherence in people with CD is limited, a previous study in adolescents found those scoring higher in perfectionism were more adherent to a gluten-free diet (Wagner et al, 2016). Potential explanations for the unexpected findings could be due to the unrealistic expectations that those with higher levels of perfectionism place on themselves, therefore leading to a fear of 'failure' and making mistakes (Frost et al, 1990). In the context of adhering to a gluten-free diet, individuals may fear the accidental consumption of gluten, and experience anxiety surrounding not being able to meet the diet 'perfectly', therefore the fear of failure may discourage people from adhering and lead to a potential process of self-sabotage (Sagar & Stoeber, 2009). Similarly, those with perfectionistic traits tend to display rigidity and inflexibility in their thinking (Hayatbini et al, 2021). This may potentially result in feelings of frustration and people may engage in a process of self-criticism if they accidently consume gluten, therefore leading them to loose motivation in adhering to a gluten-free diet.

Interestingly, there was no significant associations between length of diagnosis and adherence to a gluten-free diet, meaning that the duration of a CD diagnosis does not appear to be related to dietary adherence. Therefore, the literature on the duration of diagnosis on dietary adherence remains conflicted, as other cross-sectional studies found adherence to a gluten-free

diet improves with illness duration and some have either found no relationship (Silvester et al, 2007) or that dietary adherence declines (Ciacci et al, 2002).

A multiple regression analysis was carried out to investigate if any of the study variables predicted dietary adherence. The results showed self-compassion was a predictor of dietary adherence, however age, perfectionism and food attitudes and behaviours were not. Food attitudes and behaviours was hypothesised to predict dietary adherence as those who have a more positive attitude towards the gluten-free diet, may be more motivated and likely to adhere and conversely those who have more negative attitudes may be less likely and motivated to adhere (White et al, 2016). Given that there was a weak significant correlation between food attitudes and dietary adherence, an association is present however there is a possibility that other confounding factors may have had an influence, thus reducing the strength of the relationship.

Consequently, when self-compassion was subsequently removed from the regression model. It was observed that perfectionism and food attitudes become statistically significant, suggesting that these variables share common variance with the relationship between self-compassion and dietary adherence, indicating there is merit in conducting a study directly investigating the relationship between perfectionism and dietary adherence in people with CD. Consequently, this led to a statistically driven mediation model to test whether perfectionism and food attitudes and behaviours mediate the relationship between self-compassion and dietary adherence.

The mediation analysis showed significance for the total and direct effects of self-compassion on adherence, meaning the relationship between self-compassion and dietary adherence is significant before and after accounting for the mediating variables. However, the indirect effects of self-compassion through the mediating variables of, perfectionism and food attitudes and behaviours were found to be non-significant. Therefore, the relationship between

self-compassion and adherence is not mediated by those variables. This finding is consistent with Dowd & Jung. (2017) who also reported a significant direct effect from self-compassion to adherence in people with CD, adding to the evidence-base that people who are more self-compassionate are more likely to adhere to medical regimens (Allen et al, 2012). Additionally, two component pathways were significant in the mediation model, self-compassion to perfectionism and self-compassion to food attitudes and behaviours. The β coefficient values show that the higher the levels of self-compassion, the lower the levels of perfectionism and higher levels of self-compassion indicate better food attitudes and behaviours. Therefore, highlighting further research into the role of perfectionism in people with CD is required.

**Discussion of Results: QoL**

Pearson's correlation showed a significant relationship with all study variables, meaning that all variables were associated with QoL in people with CD. Therefore, all variables were entered into a regression analysis to determine predictors of QoL. However, with all variables entered into the regression only dietary adherence and food attitudes and behaviours predicted QoL.

In terms of the correlation analysis, associations showed that with increasing age, QoL improves and the later someone is diagnosed the poorer their QoL, this is consistent with findings reported by (Ciacci et al, 2003), who found people diagnosed before the age of twenty-years old reported better QoL. Theoretically, earlier diagnosis may lead to an alleviation of CD symptoms thus improving overall physical health. Earlier adherence to a gluten-free diet may prevent the aforementioned long-term complications in people with CD and given the delays in diagnosis and often distressing processes of being diagnosed, an early diagnosis may optimise QoL for people (Nordyke et al, 2011; Zarkadas et al, 2013). Additionally, it was found that the longer a person has CD, the better their QoL. This is consistent with other studies as

QoL has been found to significantly improve with duration of the diagnosis and duration of adherence to a gluten-free diet (Violato et al, 2019).

Higher levels of perfectionism were found to be associated with lower QoL, this is the first study to report a relationship between perfectionism and QoL in people with CD. Generally, those who are more perfectionistic have been found to experience higher rates of depression and anxiety and poorer QoL (Wright et al, 2021). Significance between self-compassion and QoL, indicates that better levels of self-compassion are associated with better QoL and as adherence to a gluten-free diet worsens, so does QoL. As expected, a strong correlation with food attitudes and behaviour was found, meaning that feeling more limited by the disease is associated with poorer QoL. Poorer food attitudes and behaviours can be explained by a range of psychological, physical and social factors (Barberis et al, 2019; Möller et al, 2021).

As the regression model with all variables accounted for 58.3%, dietary adherence and food attitudes and behaviours were removed from the regression, interestingly perfectionism and self-compassion became significant predictors of QoL. This introduced the possibility of a statistically-driven mediation model in which the direct effects of food attitudes and behaviours and dietary adherence may be mediated through self-compassion and perfectionism. As the mediation showed significant total and direct effects, it indicates food attitudes and behaviours and dietary adherence predict QoL, and the mediating variables self-compassion and perfectionism do not impact this relationship and the model is still significant in the presence of the insignificant pathways. The model presented with four significant component pathways between; food attitudes and perfectionism, food attitudes and self-compassion, adherence and perfectionism and adherence and self-compassion, showing that these effects are important factors to be considered in people with CD.

**Strengths & Limitations**

This study focused on the relationship between self-compassion, perfectionism, dietary adherence and QoL using a cross-sectional methodology. There are several strengths to the study. Firstly, to the best of our knowledge, this study is the first to look at the impact of perfectionism on dietary adherence and QoL in people with CD. The study has added to the limited existing literature on the relationship between self-compassion, QOL and dietary adherence (Dowd & Jung, 2017). Additionally, another strength of the study is its large sample size and its use of specific CD measures in the CD-FAB, CD-QOL and the CDAT.

However, the generalisation of results requires caution beyond this sample for several reasons. Firstly, the population was composed of 94.8% females; interestingly women are diagnosed twice as frequently than men (Thomas et al, 2009) and report a lower QoL and higher distress than males (Hallert et al, 2003), however this may be due to difficulties in recruiting males, indicating that further research into the psychological factors in males with CD would be beneficial. Secondly, the population sample of the current study was mostly from Western countries (approximately 97%) with 42.4% from Australia and 40.2% from UK. Given that CD is present and experienced by people from all ethnicities, races and in Non-Western countries e.g. India, Middle-East and Asia (Krigel et al., 2016) the findings from this study cannot be generalised to all ethnic groups. Furthermore, the demographic information collected showed 80.0% of participants were under the age of forty-four, potentially a consequence of recruiting online via social media pages as typically social media users are younger (Jiang et al, 2022).

Another limitation of this study is its reliance on self-report measures. The study relied on participants being truthful that they had received a biopsy or blood-test diagnosis of CD prior to completing the measures. Although it is hoped that people were honest and specified accurate methods and dates of diagnosis, it is a possibility that this may affect the reliability of the data. Future research would benefit from having healthcare professionals administer and

confirm a diagnosis. Furthermore, in relation to the self-report measures five measures were used, it is possible that participants found the measures lengthy in duration to complete, hence explaining the dropouts. Additionally, accurately measuring adherence can be challenging as it relies on individuals to be honest and have insight and understanding into the requirements of a gluten-free diet (Wieser et al, 2021).

Finally, as participants were recruited through various online CD platforms and social media pages, this may have inherently led to the recruitment of participants who were more invested and motivated to participate.

**Clinical and Research Implications**

The findings from this study have several clinical and research implications. The associations found between age of diagnosis and length of diagnosis with dietary adherence and QoL are important, indicating that being diagnosed and tested early can lead to better QoL and adherence later in life (Rubio-tapia et al, 2012). Therefore, healthcare professionals, in particular GPs, could prioritise assessment and the diagnostic assessing for those presenting with CD symptoms, as previous research has shown early diagnosis can prevent years of distress in living with deliberating symptoms, uncertainty and anxiety (Hershcovici et al, 2010). Furthermore, once diagnosed, it is important for healthcare professionals to recognise and assess psychological functioning in people with CD (Rocha et al, 2016) and integrate psychological support appropriately within the multidisciplinary team, particularly in the light of the elevated prevalence rates of depression and anxiety in this population group and associated poorer QoL during the earlier stages after diagnosis (O'Shaughnessy et al, 2021). Providing appropriate psychological support could potentially reduce healthcare burden.

From a psychological perspective, peoples' attitudes and behaviours towards a gluten-free diet are consistently found to impact their dietary self-management and QoL (Gholmie et

al, 2023). Psychological interventions would benefit from exploring the perceptions people with CD have towards the condition, the prospect of life-long adherence to a gluten-free diet and the perceived barriers to adherence. Other social factors that often contribute towards QoL would also be helpful to consider, such as, the perceptions around socialising (Hallert, 2003) and dining out of the home, being in settings where cross-contamination is a possibility and access to gluten-free foods (Whitaker et al, 2009; White et al, 2016).

This study has highlighted the importance of self-compassion in respect to dietary adherence and QoL in people with CD. A way of approaching this clinically is to explore people's self-compassion and self-criticism in the event of challenges in relation to their CD. Strategies to increase self-compassion within routine treatment can be incorporated by all healthcare professionals and psychological strategies such as cognitive restructuring, mindfulness and behavioural activation could be considered by mental health professionals (Dowd & Jung, 2017). Third-wave therapeutic interventions that incorporate self-compassion, such as Compassion-Focused Therapy (CFT) and Acceptance and Commitment Therapy (ACT) (Muhammad et al, 2020) may prove to be helpful in the management of co-morbid depression and anxiety symptoms that may influence a person's QoL with the aim of improving dietary adherence (Canova et al, 2021). This also applies for those who display perfectionistic traits and engage in a process of self-criticism in the event of perceived 'failure' around managing the diet.

Future research would benefit from conducting a replication of the current study in a male population group, in people over the age of 40 and with people from other ethnicities both nationally and internationally. Future research would also benefit from recruiting participants from clinical settings as opposed to online social media sites, to compare outcomes. Further research into the area of perfectionism in people with CD is warranted, given the existing literature on hyper-vigilance to gluten in some individuals, perhaps through the use of other or

disease-specific perfectionism measures and longitudinal study designs would also be recommended.

Overall, the findings and clinical implications from this study indicate factors such as self-compassion and perfectionism are important to consider within clinical practice, to enable and empower people not to feel so restricted when having to adhere to a gluten-free diet, and to manage the emotional burden of living with Coeliac Disease.

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## Chapter 3: Press Release For The Literature Review

## Symptoms Of Depression And Anxiety Can Be Improved By Acceptance And Self-Compassion Therapies For People With Health Conditions That Require Diet Management.

According to a new review conducted by The University of Birmingham, there is a 'newer generation' of psychological therapies which may support people experiencing symptoms of depression and anxiety related to long-term chronic health conditions requiring dietary management, such as Type 2 Diabetes, Cardiovascular Disease, Coeliac Disease (CD) and Irritable Bowel Syndrome (IBS). Type 2 Diabetics are recommended to eat complex carbohydrates, reduce the intake of saturated fats, and eat lean protein to help manage blood glucose levels (Stark Casagrande et al, 2013). Cardiovascular Disease can be managed by reducing foods high in saturated fats, reducing salt intake and increasing the consumption of fruits and vegetables (Bhupathiraju et al, 2013). For CD, the only available treatment is a gluten-free diet (Mcgough & Cummings, 2005) whilst for IBS it is important to increase fibre intake and follow a specific diet named the 'FODMAP diet' (Gibson, 2017). People with these conditions may feel distressed and may struggle to accept the changes required to manage their condition, or may see having the condition as a burden, thus contributing to poorer mental health.

This review compared 34 existing studies that investigated the effectiveness of a range of psychological therapies (Compassion Focused Therapy (CFT), Dialectical Behavioural Therapy (DBT), Acceptance Commitment Therapy (ACT), Mindfulness-based Stress Reduction (MBSR) and Mindfulness-based Cognitive Therapy (MBCT)) on symptoms of anxiety, depression, and Quality of Life (QoL), in adult participants with Type 2 Diabetes, Cardiovascular Disease, CD and IBS. All of the included papers compared those who had

received a psychological intervention with those who had not. Those who did not receive a psychological intervention continued to receive treatment as usual.

The results of this study found that, Acceptance Commitment Therapy may be helpful for IBS and Type 2 Diabetes, and Compassion Focused Therapy may be considered for IBS and Coeliac Disease, for people with symptoms of depression. Acceptance Commitment Therapy should be considered for IBS and Type 2 diabetes and Compassion Focused Therapy for Cardiovascular Disease, Coeliac Disease, and IBS, for people with symptoms of anxiety.

This research study is the first of its kind to focus specifically on dietary-managed health conditions, and the psychological interventions that may support this group of people to improve their overall psychological wellbeing.

In conclusion, healthcare professionals should explore if people who have dietary-managed health conditions and also symptoms of depression and anxiety, would benefit from psychological therapies. Mental health professionals should consider acceptance-based and compassion-based therapies that may help people begin to be less self-critical to themselves and help them to accept and live with their long-term health condition better.

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## Chapter 4: Press Release For The Empirical Research Paper

## Coeliac Disease: Self-Compassion Can Improve Psychological Well Being

### Background

People with Coeliac Disease (CD) are more depressed and anxious, (Clappison et al., 2020) and have a poorer Quality of Life (QoL) than the general population (Mirijello et al, 2019). However, research shows QoL can improve when people follow the gluten-free diet (Enaud et al, 2022), this is currently the only effective treatment for CD. Despite this, only 42% to 91% of people with CD follow the diet (Hall et al, 2009) and researchers have been trying to understand why this is. Research has shown that the attitudes people have towards food, and how they behave around food can impact how they follow the diet and their QoL (Möller et al, 2021). Psychological factors such as perfectionism have not yet been investigated in people with CD specifically, but has been associated with lower QoL in people with other long-term conditions such as chronic back pain (Ardalani Farsa et al, 2021) and in people with eating disorders (Rutter-Eley et al, 2020). Perfectionism has also been linked to poorer self-compassion (Linnett & Kibowski, 2020), but one study (Dowd & Jung, 2017) has found that greater self-compassion can lead to people with CD to follow the gluten-free diet more successfully, leading to better QoL.

### What did the study do?

This study aimed to explore the relationships between self-compassion, perfectionism, food attitudes and behaviours, adherence to the gluten-free diet and QoL, in people with CD. The study recruited people through CD specific social media groups, asking them to complete a set of online questionnaires. There were 458 people that took part in the study, completing five questionnaires; exploring self-compassion, perfectionism, QoL, how well they manage the

gluten-free diet and their attitudes and behaviours towards food. The data was analysed to look closely at the relationships between the various concepts and a variety of statistical tests were performed, including correlation, regression, and mediation analysis.

**What did the study find?**

Over 94% of the sample was female and 80% of the participants were under the age of forty-four. The results identified that better self-compassion and food attitudes and behaviours, and lower levels of perfectionism were associated with better management of the diet. Self-compassion was important in managing the diet well.

Further analysis showed that people who experienced better QoL had better self-compassion and more positive attitudes to food, and better management of the diet. Furthermore, people who were less perfectionistic and people who had been diagnosed for longer, experienced better QoL. Finally, self-compassion was found to be a key factor in managing the diet well.

**What do the results mean?**

The research shows the importance of considering psychological factors in people with CD, in particular self-compassion, and perfectionism. Healthcare professionals could incorporate compassion-based strategies into routine appointments, with the support of psychologists. For those people who struggle particularly with their diet, and require more specialist psychological input, compassion-focused strategies could be used. Other factors, such as a person's willingness to socialise and eat outside the home could also be explored, taking into consideration a person's attitudes towards foods and their tendency for perfectionism around their diet.

**Empirical Press Release References**

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# APPENDICES

## Appendix A: Study Ethical Approval Letter

Dear Dr Law

**Re: "The relationship between perfectionism, self-compassion, dietary adherence and quality of life in people with Coeliac Disease"**
**Application for Ethical Review ERN_21-1176**

Thank you for your application for ethical review for the above project, which was reviewed by the Science, Technology, Engineering and Mathematics Ethical Review Committee.

On behalf of the Committee, I confirm that this study now has full ethical approval.

I would like to remind you that any substantive changes to the nature of the study as described in the Application for Ethical Review, and/or any adverse events occurring during the study should be promptly brought to the Committee's attention by the Principal Investigator and may necessitate further ethical review.

Please also ensure that the relevant requirements within the University's Code of Practice for Research and the information and guidance provided on the University's ethics webpages (available at https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Links-and-Resources.aspx ) are adhered to and referred to in any future applications for ethical review. It is now a requirement on the revised application form (https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Ethical-Review-Forms.aspx ) to confirm that this guidance has been consulted and is understood, and that it has been taken into account when completing your application for ethical review.

Please be aware that whilst Health and Safety (H&S) issues may be considered during the ethical review process, you are still required to follow the University's guidance on H&S and to ensure that H&S risk assessments have been carried out as appropriate. For further information about this, please contact your School H&S representative or the University's H&S Unit at healthandsafety@contacts.bham.ac.uk.

Kind regards

**Mrs Susan Cottam**
Research Ethics Manager
Research Support Group
University of Birmingham
Email:

**Appendix B: Participant Information Sheet**

**Title of Research: The relationship between self-compassion, perfectionism and dietary adherence in people with Coeliac Disease**

**Participant Information Sheet**

You are being invited to participate in a research study. Before you agree it is important that you understand what your participation will involve. Please take time to read the following information carefully.

**What is my role is this research project?**
My name is Shivani Kumar and I am a trainee clinical psychologist, studying the doctorate in clinical psychology at the University of Birmingham. This research project will contribute to my doctoral thesis.

**What is the purpose of the research?**
Individuals with a diagnosis of Coeliac Disease are advised to follow a strict gluten-free diet. I want to find out if there is a relationship between how compassionate people are to themselves (self-compassion) and how well they are able to follow the gluten-free diet.
I will also be trying to understand if perfectionism influences the gluten-free diet and a person's quality of life. Perfectionism is defined as a broad personality style where an individual strives 'to be perfect.' It is often accompanied by negative self-evaluations.

The purpose of this research will help to identify what kind of support and interventions are needed, in order to provide compassionate care.

**Ethics Approval**
My research has been approved by the School of Psychology Research Ethics Committee. This means that the Committee's evaluation of this ethics application has been guided by the standards of research ethics set by the British Psychological Society. All research conducted at The University of Birmingham is looked at by an independent group of people, called a Research Ethics Committee to protect your safety, rights, well-being and dignity.

**What will my participation involve?**
If you agree to participate you will be asked to complete an online survey which will last approximately 10-15 minutes. You can complete this on any device (laptop, phone etc.) You will not be asked to provide your name or any other identifiable information and all your data will remain anonymous and confidential. All the instructions will be clearly available on the survey. You will need to ensure you click the "submit" button at the end of the survey in order to save you data so it can be used in the study.

**Who is being asked to take part in this study?**
I am hoping to recruit people who are over the age of 18 with a diagnosis of Coeliac Disease.

**Are there any disadvantages or risks to taking part?**
The questions are not designed to cause distress. If you experience any distress from the survey, you are free to stop at any point without providing a reason for doing so. Support organisations will be provided in the debrief form at the end of the survey.

**How will my information be kept safe and confidential?**
Your privacy and safety will be respected at all times. You will not be asked to enter any identifiable information (e.g. name, date of birth), therefore your data will not be identifiable. The online survey will make use of anonymous links, meaning location data and IP addresses will not be stored or linkable to survey responses. Anonymised data will be stored for a maximum of three years on a password protected database. Within this time, only the research team will have access to the data. Once analysed, data will be used for the write-up of the research and disseminated as appropriate. This will include findings being disseminated to a range of audiences (e.g. academics, clinicians, the public), through journal articles, presentations, talks and other relevant articles, as appropriate. Data will be stored in accordance to GDPR guidelines.

**What will happen to the information that I provide?**
The survey will be conducted online, all data will therefore be anonymous and your data will not be identifiable. You are free to withdraw from the study at any point during completion, however, you will not be able to withdraw from the study once all questionnaires have been submitted.
Data will be stored in accordance with the University of Birmingham's data storage policy.

**Who can I contact if I have questions about the study?**
If you would like further information about my research or have any questions or concerns, please do not hesitate to contact me.

Name: Shivani Kumar
Email: [redacted]

You may find the following resources/services helpful in relation to obtaining information and support:
• Coeliac UK - https://www.coeliac.org.uk/home/
• The Samaritans: 116 123. A free 24/7 helpline for anybody experiencing distress. https://www.samaritans.org/
• Your General Practitioner (GP) can signpost you to additional services if you experience emotional distress.

**Appendix C: End Of Study Completion Page**

**Thank you for taking the time to complete this survey.**

**Your responses have been recorded.**

You may find the following resources/services helpful in relation to obtaining information and support:

• Coeliac UK - https://www.coeliac.org.uk/home/

• The Samaritans: 116 123. A free 24/7 helpline for anybody experiencing distress. https://www.samaritans.org/

• Your General Practitioner (GP) can signpost you to additional services if you experience emotional distress.

## Appendix D: List Of Co-Morbid Conditions Specified By Participants

| Condition | Frequency | Condition | Frequency |
|---|---|---|---|
| Asthma | 25 | Anaemia | 1 |
| Hypothyroidism | 17 | Arthritis | 1 |
| Anxiety | 16 | Barrett's oesophagus | 1 |
| Severe allergies | 14 | Bile acid malabsorption | 1 |
| Depression | 14 | Blood disorder | 1 |
| Hashimoto disease | 13 | Bowel cancer | 1 |
| PCOS | 13 | Brca 2 generic mutation | 1 |
| Endometriosis | 12 | Chronic gastritis | 1 |
| Chronic migraines | 10 | Chronic Myeloid Leukaemia | 1 |
| Hypertension | 9 | Complex regional pain syndrome | 1 |
| Fibromyalgia | 7 | Costochondritis | 1 |
| Crohn's disease | 6 | cPTSD | 1 |
| IBS | 6 | Dermatomyositis | 1 |
| ADHD | 5 | Duplex kidneys | 1 |
| Chronic Fatigue | 5 | dysautonomia | 1 |
| Eczema | 5 | Ehlers Danlos | 1 |
| Osteoporosis | 5 | Factor V Leiden mutation | 1 |
| Psoriasis | 5 | Frozen Shoulder | 1 |
| Scoliosis | 5 | Functional Neurological Disorder | 1 |
| Cardiovascular Disease | 4 | G6PD deficiency | 1 |
| Lactose intolerance | 4 | Gastric reflux | 1 |
| Lupus | 4 | GERD | 1 |
| Osteoarthritis | 4 | Giant cell Arthritis | 1 |
| Type 1 Diabetes | 4 | Hemochromatosis | 1 |
| Diverticulitis | 3 | Hernia | 1 |
| Graves' Disease | 3 | Homocystinuria | 1 |
| Hay fever | 3 | Hydronephrosis | 1 |
| Osteopenia | 3 | Idiopathic granular mastitis | 1 |
| Reflux | 3 | Intolerance to all Dairy products | 1 |
| Rheumatoid Arthritis | 3 | Kidney disease | 1 |
| Ulcerative Colitis | 3 | Marfan's syndrome | 1 |
| Adenomyosis | 2 | MGUS | 1 |
| ASD | 2 | Multiple sclerosis | 1 |
| Atrial fibrillation | 2 | Other mental illnesses | 1 |
| Eosinophilic esophagitis | 2 | Persistent Postural Perceptual Dizziness | 1 |
| Epilepsy | 2 | Post Graves' Disease thyroidectomy | 1 |
| Hyperthyroidism | 2 | Pyoderma gangrenosum | 1 |
| IBD | 2 | Pyrexia | 1 |
| Insomnia | 2 | Rosacea | 1 |
| Insulin resistance | 2 | Sacroiliitis | 1 |
| Meniere's disease | 2 | Sjogren's | 1 |
| Obesity | 2 | Slow colonic transit | 1 |
| OCD | 2 | SMA syndrome | 1 |

| | | | |
|---|---|---|---|
| POTS syndrome | 2 | Spina bifida occults | 1 |
| Reynard’s | 2 | Spontaneous urticaria | 1 |
| Type 2 diabetes, | 2 | Trigeminal Neuralgia | 1 |
| Von Willebrand’s | 2 | Vasovagal disease | 1 |
| Ankylosing spondylitis | 2 | Vitiligo | 1 |
| Addison's Disease, | 1 | Hypermobility syndrome | 1 |
| Achalasia | 1 | | |

## Appendix E: Frost Multidimensional Perfectionism Scale

Please note this item has been omitted from the appendices due to copyright considerations. Please refer to the references section.

**Appendix F: Neff's (2003) The Self-Compassion Scale Long Form (Sscs-L)**

Please note this item has been omitted from the appendices due to copyright considerations. Please refer to the references section.

**Appendix G: The Coeliac Disease Quality Of Life Survey (CD-QOL)**

Please note this item has been omitted from the appendices due to copyright considerations. Please refer to the references section.

**Appendix H: The Coeliac Disease Food Attitudes and Behaviours Scale (CD-FAB)**

Please note this item has been omitted from the appendices due to copyright considerations. Please refer to the references section.

**Appendix I: The Celiac Dietary Adherence Test (CDAT).**

Please note this item has been omitted from the appendices due to copyright considerations. Please refer to the references section.