

Dietary Habits and Participant-Led
Adaptations to Diet for Pain Management in
Fibromyalgia Sufferers: A Cross-Sectional
Study

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Abstract

Fibromyalgia is a disorder characterised by chronic widespread pain that has been present for more than 3 months and can be elicited by palpitation of specific touch points. It is associated with a wide range of co-morbidities including chronic fatigue and gastrointestinal disorders. Although widely accepted by wider populations to have an impact on the condition, there is limited nutritional information and associated evidence to cater specifically for the disease with widespread anecdotal and non-professional websites providing sources for dietary change. The aim of the study is to investigate the association between dietary intake and quality on pain and symptoms, in individuals with fibromyalgia.

Method

A cross sectional study was conducted. We explored the association between pain and symptoms in fibromyalgia, (Revised Fibromyalgia Impact Questionnaire, FIQR; General Anxiety Disorder, GAD-7 and Patient Health Questionnaire, PHQ-9) and markers of metabolic health (anthropometry) against dietary intake (EPIC Food Frequency Questionnaire, FFQ), diet quality (Healthy Eating Index 2015, HEI-2015) and self-reported dietary changes.

Results

Participants were adults (n = 381) with fibromyalgia and were recruited using social media platforms including Facebook, Twitter and specific online fibromyalgia support groups. Higher pain and symptom scores (FIQR) were associated with higher BMI, higher energy intake and lower diet quality (p's <0.05). Participants with lower pain scores (FIQR <49) had significantly close adherence to dietary recommendations across 7 out of 11 components of diet quality (total fruit, whole fruits, dairy, protein, fatty acids, refined grains, saturated fats), iron intakes (p=0.18) and vitamin D (p<0.001), with significantly lower carbohydrate intake (P=0.019). No significant results were noted for other selected nutrients (Ca, Mg). Participants who report engaging with dietary modification presented with significantly lower for FIQR, BMI and energy intake (p's <0.05).

Conclusion

This study suggests a link between diet quality, dietary intakes and pain in fibromyalgia. Lower diet quality, greater BMI and higher energy intake was related to higher pain and symptoms whilst reported dietary modification resulted in lower pain and symptoms, alongside lower BMIs. Iron and vitamin D consumption were higher in participants with lower pain. Future research is needed to assess the impact of specific nutrients as well as whole dietary change on pain and symptoms in fibromyalgia via nutritional intervention studies for this patient group.

Ethics

The study has been approved by the Health, Science, Engineering & Technology ECDA, (protocol number LMS/PGR/UH/03765).

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3 Abbreviations

AEA	Aerobic exercise
ANOVA	Analysis of variance
AWMF	Association of Medical Scientific Societies in Germany
BMI	Body mass index
Ca	Calcium
CBT	Cognitive behavioural therapy
CD	Coeliac disease
CFS	Chronic Fatigue Syndrome
CHO	Carbohydrate
CNS	Central nervous system
CRP	C-reactive protein
DA	Dopamine
DRVs	Dietary Reference Values
EULAR	European League Against Rheumatism
Fe	Iron
FFQ	Food frequency questionnaire
FIQ	Fibromyalgia Impact Questionnaire
FIQR	Revised Fibromyalgia Impact Questionnaire
GABA	Gamma aminobutyric acid
GAD-7	Generalised Anxiety Disorder Assessment
HEI	Healthy Eating Index, 2015
HLA	Human leukocyte antigen (HLA)
HPA	Hypothalamic-Pituitary-Adrenal axis
IBS	Irritable bowel syndrome
ICD	International Classification of Diseases
IL- 2	Interleukin - 2
IL- 6	Interleukin - 6
IL- 8	Interleukin - 8
Kcal	Kilocalories
Kg	Kilogram

M	Metre
Mg	Magnesium
Na ⁺	Sodium
NE	Norepinephrine
NICE	National Institute for Health and Care Excellence
NKLCD	Non-ketogenic, low CHO diet
NSAIDs	Non-steroidal anti-inflammatory drugs
PHQ-9	Patient Health Questionnaire (PHQ)-9
QOL	Quality of life
RCT	Randomised controlled trails
SACN	Scientific Advisory Committee on Nutrition
SNRI	Serotonin-norepinephrine reuptake Inhibitor.
SS	Symptom severity
SSRIs	Selective Serotonin Reuptake Inhibitor
TCAs	Tricyclic antidepressants
TeCAs	Tetracyclic antidepressants
TRP	Transient receptor potential
TSH	Thyroid Stimulating Hormone
TSPO	Translocator proteins
WHO	World Health Organisation
WPI	Widespread Pain Index
5-HT	Serotonin

4 Introduction

It is estimated that around 3 million people in the UK suffer from fibromyalgia syndrome (Jones et al., 2015) and world population rates are suggested to be around 3.98% in women and 2.40% in men (Heidari, Afshari & Moosazadeh, 2017). The disease is characterised by whole body pain, increased sensitivity and lethargy (Wolfe et al., 2010). Symptoms include sleep disturbances, irritable bowel syndrome, increased fatigue and altered or reduced mental processes; anxiety and depression (Rahman, Underwood & Carnes, 2014). Chronic and often widespread pain is the most reported symptom in fibromyalgia, however, there is a lack of visible physiological abnormalities and biochemical responses to explain these manifestations (Elmas et al., 2016). Hyperalgesia, where there is increased reaction to painful stimuli and allodynia, pain caused by normally nonpainful stimuli are common symptoms (Littlejohn & Guymer, 2018). Patients display enhanced sensitivity to external stimuli including thermal changes (Littlejohn & Guymer, 2018). This often leads to a lack of medical understanding and patients being offered limited or no medical support (Sluka & Clauw, 2016). Furthermore, measurement of pain is not objective as all tools available rely on the ability for the participant to self-report (Brian et al., 2019).

Fibromyalgia is more often reported by females than males to a ratio of 2:1, however this may be due to underreporting or a lack of medical diagnosis (Rahman et al., 2014). Social stigma relating to expectation of pain management and perception that the disease only effects females, may also contribute to limited health professional contact by men (Paulson, Danielson, & Söderberg, 2002; Miró, Martínez, Sánchez, Prados, & Lupiáñez, 2015). Diagnosis appears not to be affected by ethnicity, geographical location or economic status, suggesting that fibromyalgia is a global condition (McBeth & Jones, 2007).

In 2018, Silva et al., undertook a systematic review of dietary interventions specific to fibromyalgia and were only able to identify 7 unique studies. Despite improvements highlighted in 5 of these studies the knowledge base is too small to make any final conclusions or provide dietary advice. In lieu of condition specific guidance, population

level guidance can provide a starting point to good dietary practice. This guidance provided by government public health departments and SACN is the only evidence base currently available to support those with fibromyalgia. There is limited and often conflicting nutritional research to demonstrate the benefits of dietary intervention on pain and symptoms in fibromyalgia, despite interventions showing success in comparable conditions, lending itself to research opportunities.

5 Literature Review

5.1 Symptoms and diagnosis

5.1.1 Previous and current criteria in the UK

The disease originally recognised by medical professionals in 1990 was classified as widespread pain in combination with tenderness at 11 or more of 18 specified tender point sites, **Table 1** (Wolfe, et al, 1990). In 2010, Wolfe et al. proposed new criteria to diagnose fibromyalgia that assesses widespread pain, using a widespread pain index (WPI), alongside symptom severity (SS); diagnosis is confirmed by a WPI ≥ 7 AND SS ≥ 5 or a WPI 3–6 AND SS ≥ 9 lasting more than three months with no alternative medical explanations. The WPI measures all-over pain and tenderness on both sides of the body (Wolfe, 2003) with the SS scale considering fatigue, cognitive symptoms and waking unrefreshed. The new diagnostic criteria may be undertaken by non-professionals and is the current diagnostic tool used in the UK (Wolfe et al., 2010). The FIQR tool was created in 2005 and validated in 2009 as an update to the original tool (FIQ), published in 1991 (Burckhardt, Clark & Bennett, 1991) with the assistance of a focus group of women with fibromyalgia. Changes in the tool removed the VAS scoring system in favour of numeric ratings and included the addition of environmental, memory, balance and tenderness questions in response to updated research (WHO, 2001; Bennett, 2007; Mease et al., 2007; Jones et al., 2009)

Table 1: Anatomic location of tender points according to the American College of Rheumatology 1990 classification for fibromyalgia.

Anterior tender points	Posterior tender points
------------------------	-------------------------

Low Cervical: bilateral at C5-C7.	Occiput; bilateral at the suboccipital muscle insertions.
Second rib: bilateral at the second costochondral junctions.	Trapezius; bilateral at the midpoint of the upper border.
Great trochanter; bilateral posterior to the trochanteric prominence.	Supraspinatus; bilateral above the scapular spine near the medial border.
Knees; bilateral at the medial fat pad proximal to the joint line	Lateral epicondyle; bilateral, 2cm distal to the epicondyles.
	Gluteal; bilateral, upper outer quadrants of buttocks in anterior fold of the muscle

5.1.2 Challenges in diagnosing fibromyalgia

Complications in the diagnosis of fibromyalgia arise from the common symptoms it shares with other conditions and thus, diagnosis is often confirmed by exclusion of other complaints (Arnold, Clauw & McCarberg, 2011). For example, similar symptoms are seen in several rheumatic diseases such as: rheumatoid arthritis, ankylosing spondylitis, Lyme disease and lupus, however in contrast to fibromyalgia these conditions effect the joints and not the soft tissue (Elmas et al., 2016). Further comparisons are found between fibromyalgia and autoimmune disorders leading to hyper and hypothyroidism and inflammatory conditions such as polymyalgia and metabolic myopathies, myofascial pain syndromes and chronic fatigue syndrome (CFS) (Goldberg, Bradley, Arnold, Glass, & Clauw, 2005; Kaltsas G, & Tsiveriotis K., 2017). In a systematic review of 52 studies on fibromyalgia and 95 on CFS, Teodoro, Edwards and Isaacs (2018) conclude that the conditions share cognitive symptoms, particularly with attentional dysfunction but question if current research is sufficient to suggest they are standalone conditions. Patients currently use both pharmacological and non-pharmacological approaches to manage the symptoms of fibromyalgia (Macfarlane et al., 2016).

5.2 Causes of fibromyalgia and co-morbidities

There is currently no defined cause for the development of fibromyalgia (Furness et al., 2018) and the aetiology of the condition has been the subject of many debates amongst

professionals (Wolfe et al., 2019). Excess body weight, environmental triggers that lead to prolonged increases in stress levels, genetic considerations, biochemical dysfunctions and neural inflammation have all been attributed to disease development (Backryd, et al, 2017; Bennett et al., 2007) The disease is recognised as one that is challenging to diagnose (Wolfe & Walitt, 2013), often due to physician bias, social stigma leading to changes in patient behaviours and perception of the disease (Bidari, Parsa, Ghalehbaghi, 2018).

5.2.1 *Excess body weight*

There is evidence to suggest that excess body weight has a negative influence on pain levels in fibromyalgia, although there is no evidence to suggest that obesity is a cause for disease manifestation (Yunus, Arslan and Aldag, 2002). A study by Lerner et al., (2008) reported of 100 patients randomly selected from 550 fibromyalgia sufferers, 28% were overweight and 45% obese, significantly higher than population average of approximately 26% (House of Commons, 2018). An internet survey of 2596 fibromyalgia patients yielded similar results with 70% of respondents reporting a body mass index (BMI) > 25kg/m² and 43% a BMI > 30kg/m² (Bennett et al., 2007). Significant correlations between BMI, quality of life and tenderness thresholds were seen when undertaking health assessment questionnaires, directly associating BMI with symptoms (Neurmann et al., 2008). A negative correlation was experienced between BMI, pain threshold and quality of life (QOL) factors whilst a positive correlation was seen with physical dysfunction. Further studies indicate a similar correlation between BMI, fatigue and pain (Yunus, Arslan, & Aldag, 2002).

Shapiro, Anderson, & Danoff-Burg, (2005) found significant improvements in symptoms, pain interference and QOL measures in patients undertaking a weight loss program. The reasons for this may be attributed to decreased energy requirements (Hall et al., 2012) and a reduced pressure on joints (Messier, Gutekunst, Davis & DeVita, 2005). A positive correlation between weight loss and improvements in depressive symptoms suggest reducing excess body weight may attribute to symptom improvements (Alhalel,

Schueller, O'Brien, 2018; Faulconbridge et al., 2009). A reduction in BMI may be the primary cause of pain management in this disease, beyond dietary modification (Timmerman, Calfa & Stuijbergen, 2013). The impact of participant BMI in studies is not always considered. Some research suggests this excess body weight limits the effectiveness of undertaking nutritional research (Fenton et al., 2016).

5.2.2 *Psychological disorders and depression*

Psychological disorders, particularly depression and anxiety are commonly seen in patients with fibromyalgia (Furness et al., 2018; Hawkins, 2013). Participants with fibromyalgia are 3.04 times more likely to suffer from depressive symptoms than those without the disease (Zamini, Alizadeh and Zamini, 2019). It has been suggested that fibromyalgia and depression may represent two manifestations of affective spectrum disorder, a group of psychiatric and medical conditions that share similar pathophysiology, pharmaceutical interventions, namely antidepressants and neurotransmission pathways (Gracely, Ceko & Bushnell, 2012). Depressive symptoms are frequently reported and significant numbers of individuals with fibromyalgia are diagnosed with a psychiatric comorbidity, including bipolar, major depressive disorders and anxiety (Morgan & Raper, 2005; Singh & Kaul, 2018, Steiner et al., 2017).

There is clear evidence linking chronic pain and depression (Sheng, Liu, Wang, Cui & Zhang, 2017), both sharing similar pathophysiology, and the World Health Organisation suggests that 75% of patients with depression in primary care, report symptoms of pain (Lepine & Briley, 2004). Co-existence of the diseases appears to increase overall symptom severity (Sheng, et al., 2017). A World Health organisation (WHO) study involving screening either random or consecutive patient samples for depression, in 14 countries over a 1-year period from May 1991, found that of 1146 patients that met the criteria for major depression only 69% presented with symptoms, suggesting potential under-reporting of the condition (Simon, et al., 1999). Common underlying molecular mechanisms across conditions include dysfunctions of monoamine neurotransmitters, including serotonin (5-HT), dopamine (DA), and norepinephrine (NE), indicating why tricyclics like Amitriptyline, that inhibit 5-HT and NE reuptake, may work across

conditions (Kremer, Salvat, Muller, Yalcin & Barrot, 2016). Sensory pathways in brain regions involved in pain modulation, including the hippocampus, amygdala and prefrontal cortex are also involved in mood management (Meerwijk, Ford & Weiss, 2013). Although there are some suggestions that chronic pain and depression are linked on a biochemical level, limited efficacy of current treatments means more exploration into non-pharmaceutical approaches including nutrition-based therapy are required to treat pain symptoms (Brian et al., 2018).

5.2.3 *Environmental Triggers*

Environmental triggers may be involved in the pathophysiology of fibromyalgia. These triggers include mechanical or physical trauma and psychosocial stressors (Clauw, 2014). Patients report the onset of fibromyalgia following a bereavement or other traumatic experience, accident resulting in injury and even childbirth (Furness et al, 2018). An internet questionnaire undertaken by Bennett, et al., (2007) of 2596 fibromyalgia sufferers found that 73% attributed the onset of the disease to emotional trauma or chronic stress (41.9%). Acute illness (26.7%) or physical injury, including surgery were also reasons strongly attributed to disease development. A further 20.6% of responses cited emotional and/or physical abuse, childhood sexual abuse or the menopause. 98.4% of respondents had a formal diagnosis from a medical professional. A potential neuro-endocrine link between stress and fibromyalgia involving the Hypothalamic-Pituitary-Adrenal (HPA) axis disturbances and deranged cortisol levels, is attributed to early life stressors (Harris et al., 2005), however these disturbances are only reported within one hour of waking, leading to suggestions further research is required to understand this mechanism.

5.2.4 *Genetic Associations*

There is a strong familial aggregation in fibromyalgia sufferers suggesting that a genetic element may be involved in the development of the disease (Arnold et al., 2004). Furthermore, mood disorders, such as major depressive disorder and bipolar, may share the same genetic influence (Broad et al., 2009). Lower back pain, frequently seen in fibromyalgia and chronic widespread pain share common genetic factors and are

associated with increased BMI (Malkin et al., 2014). Arnold et al., (2013) used suggestive wide genome linkage of fibromyalgia to the chromosome 17p11.2-q11.2 region. This region coincides with transient receptor potential TRP vanilloid 2, (TRPV2) gene. Transient receptor potential channels are a group of unique ion channels that serve as cellular sensors for a wide array of physical and chemical stimuli (Ramsey, Delling & Clapham, 2006). The TRP family, including TRPV1, TRPV4, and the ankyrin transmembrane protein TRPA1, are thought to contribute to pain by transmitting noxious thermal, mechanical and chemical sensitivities (Premkumar & Abooj, 2013) and more specifically pathological pain associated with inflammatory and neuropathic states. TRPV2 may play a role in mediating pain but its role in fibromyalgia is not currently understood (Broad et al., 2009).

5.2.5 *Biochemical Associations*

Biochemical systems in the body may mediate symptom intensity in patients with fibromyalgia, including dysfunctional neuronal signalling leading to nociceptive signalling and inflammation (Sluka & Clauw, 2016). Elevated levels of pro-inflammatory interleukin-8 (IL-8) in cerebrospinal fluid can result in nociception-driven amplification of neural signaling, increasing pain hypersensitivity in the central nervous system (Backryd, Tanum & Lind et al., 2017; Kadetoff, Lampa, Westman, Andersson & Kosek, 2012; Wolfe, 1990). In turn this leads to increased nociceptive processing, creating somatic symptoms affecting mood, memory and fatigue (Sluka & Clauw, 2016). Further evidence to support this theory relates to allodynia and hyperalgesia, often experienced in fibromyalgia, alongside CNS mediated symptoms such as fatigue, memory and sleep disorders (Littlejohn & Guymer, 2018). Fundamental problems with sensory processing in the CNS result in pain amplification. Functional imaging studies report imbalances in both glutamate and GABA neurotransmitters levels, found in patients with fibromyalgia, that have a direct effect on the transmission of pain in these patients (Clauw, 2014; Harris & Clauw, 2012).

Biochemical alterations may lead to increased inflammation, however there is some dispute to its existence in fibromyalgia (Tanaka, Narazaki, & Kishimoto, 2014). Metyas,

Solyman and Arkfeld (2015), argue however that fibromyalgia patients should be split into subgroups which acknowledge those patients that have inflammation present but no other existing comorbidities. Alterations in pro-inflammatory cytokines have been detected in both serum and biopsies of patients. Ernberg et al., (2018) reported that baseline levels of interleukin – 2 (IL-2), responsible for white blood cell regulation; interleukin – 6 (IL-6), stimulation of acute phase responses; TNF- α , involved in systemic inflammation; CXCL10, chronic hepatitis C infection and eotaxin, produced in the lungs of asthmatics, were higher in FM than in healthy controls. IL-1 β responsible for the host response and resistance to pathogens, was recorded in lower levels (Lopez-Castejon & Brough, 2011; Sprott Souzan Salemi et al., 2003; Tanaka, Narazaki, & Kishimoto, 2014). Serum inflammatory markers for interleukin-6 (IL-6) and C-reactive protein (CRP) are elevated in obese patients with fibromyalgia (Blüher et al., 2005). Evidence suggests that whilst inflammation is not currently considered a diagnostic criterium for fibromyalgia, further research should be undertaken to establish the role in the disease.

5.2.6 *Neuro-inflammation*

New evidence suggests that there is a link between neuroinflammation and the development of fibromyalgia. Albrechta et al., (2019) report neurochemical changes in patients with fibromyalgia when compared with healthy participants. These changes, mediated by activation of glial cells, were measured using PET radiopharmaceuticals binding to Translocator proteins (TSPO), a marker for inflammation. TSPO is overexpressed in activated glial cells and increased numbers were observed in patients with fibromyalgia when compared to healthy patients (Littlejohn & Guymer, 2018). More importantly, no discrimination was seen in TSPO elevation between brain regions suggesting a correspondence to the complex symptom patterns of fibromyalgia. A direct correlation was found between comparative levels of TSPO in the cingulate gyrus, an area of the brain associated with emotional processing and reported levels of chronic fatigue, further indicating an association between neuroinflammation and fibromyalgia symptoms (Backryd, et al., 2017). Yasui et al., (2019) observed microglial activation in the absence of peripheral nerve damage and inflammation in a stress induced

environment using an animal model of fibromyalgia. This suggests that microglial activation may play a role in the pain initiation in patients with chronic pain.

5.3 Symptom management

5.3.1 Pharmacological approaches

Current symptom management is primarily based on pharmaceutical interventions (Sugerman, 2014). Tricyclics (antidepressants) work to increase levels of norepinephrine and serotonin, where deficiencies in these neurotransmitters have been linked to depressive symptoms (Moret & Briley, 2011). These drugs block the action of acetylcholine, a regulator of neuronal activity throughout the peripheral and central nervous system, overexpression of which may lead both to increased depression symptoms and CNS sensitivity (Harmer, Duman & Cowan 2017, Higley & Piccioto, 2014). Gabapentinoids (ligands) act as selective blockers of calcium channels that contain the $\alpha 2\delta$ -1 (Sills, 2006), which contribute to neuropathic pain (Chen et al., 2018). Serotonin norepinephrine reuptake inhibitors (SNRIs) are indicated to manage depression, anxiety and chronic pain by inhibiting the reuptake of both serotonin and norepinephrine, implicated as principal mediators of endogenous analgesic mechanisms in the descending pain pathways (Lamont, Tranquilli & Grimm, 2000). Commonly, physicians prescribe, or patients purchase over the counter pain relievers like aspirin and ibuprofen both indicated to manage pain (Sugerman, 2014). Although some medication may have multiple applications, patients often find that they require multiple prescriptions to manage the various elements of their own condition (Kwiatek, 2017). Patients often report negative side effects to medication, commonly citing weight gain (Domecq et al, 2015).

Amitriptyline, more commonly used to treat symptoms of depression, is the first line treatment for fibromyalgia and is recommended in many guidelines including European League Against Rheumatism (EULAR) and the Association of Medical Scientific Societies in Germany (AWMF) however it is not currently licensed to treat neuropathic pain in the UK (Hauser et al., 2008; Kia & Choy, 2017; Macfarlane et al., 2016).

Amitriptyline inhibits both serotonin and noradrenaline reuptake, suppressing the role of

these neurotransmitters, in the modulation of neural activity and neuropsychological processes, that impacts endogenous pain inhibitory mechanisms (Lawson, 2017). However, studies are limited and there is potential that only a minority of patients have satisfactory symptom relief (25%) and significant numbers of patients experience adverse effects (64%), including weight gain (Arnold et al., 2013; Kwiatek, 2017; Moore, Derry, Aldington, Cole, & Wiffen, 2013). Patients often report weight gain as a major side effect of Amitriptyline with an average of 1.8kg increase (Domecq et al., 2015). One explanation may be as a result of the influence of Amitriptyline on leptin resistance, causing an increase in serum leptin levels that increase susceptibility to weight gain (Fleisch et al., 2007).

Milnacipran, is a selective serotonin and norepinephrine reuptake inhibitor (SNRI), originally developed for the treatment of depression and licensed to treat fibromyalgia in some countries including the USA (Cording, Derry, Phillips, Moore & Wiffen, 2015). Milnacipran appears to resolve the issue of weight gain and may promote weight loss. Serotonin and norepinephrine reuptake inhibitors (SNRIs) are effective in the treatment of depression and their use in fibromyalgia is currently a focus of research (Arnold, Palmer, Hufford, & Chen, 2012). Physical symptoms of pain are often characterised alongside major depressive disorder and anxiety disorders, therefore a link between the management of both diseases may be implicated (Marks et al., 2009). Animal studies indicate that noradrenaline plays an important role in the inhibition of neuropathic pain, through the α_2 -adrenergic receptors in the dorsal horn of the spinal cord and reuptake inhibition enhances analgesic effects, indicating effectiveness against allodynia and hyperalgesia associated with neuropathic pain (Kimura, Saito & Obata, 2012; Paquerin, Conkilyn & Eisenach, 2003), suggesting the efficacy of antidepressants in treating neural pain, relies in the increase in noradrenaline in the spinal cord (Obata, 2017). SNRIs are also successful in treating depressive symptoms. A systemic review and meta-analysis by Cipriani et al., (2018) reports off 522 clinical trials all 21 antidepressants identified were more effective than placebo.

Pharmacological therapies are often insufficient and ineffective in combating pain in fibromyalgia (Domecq et al., 2015). A multi-disciplinary approach involving medications alongside non-pharmacological interventions is suggested by the European League Against Rheumatism (EULAR), due to the polysymptomatic nature of the condition (Carville, et al., 2008). Nutrition is an important alternative approach and when used in combination with medications has shown some success in alleviating symptoms and in some cases resulted in the total removal of all pharmaceuticals (Senna et al., 2012).

5.4 Non-Pharmacologic Treatments

A lack of success with conventional treatments has grown the need for alternative and complementary measures to target fibromyalgia symptoms (Abeles, Solitar, Pillinger & Abeles, 2008). Physical activity levels, cognitive behavioural therapy, alternative medicines, patients and clinician education all appear to have an influence on pain, depression and other symptoms.

5.4.1 Physical Activity

Exercise and strengthening activities in fibromyalgia are used as a form of therapy to relieve symptoms (Hauser et al., 2010). In comparison to no exercise, improvements in wellbeing, tender point reactions to pain stimulation and pain are reported, however the effects on fatigue and stiffness are unknown, in aerobic exercise (AE) (Busch, Barber, Overend, Peloso & Schachter, 2007). Strength training has shown a greater effect on pain reduction and overall wellbeing, but evidence is of low quality, due to limited reported details, preventing further evaluation (Busch, Schachter, Peloso & Bombardier, 2002). Hauser et al., (2010) compared 28 randomised controlled trials (RCTs) for AE against controls and seven RCTs comparing different methods of AE. Positive results were seen in pain, fatigue, depressive symptoms and QOL measures and post treatment pain was reduced with both land and pool-based exercise. Jones & Lipton (2009) found similar conclusions for yoga, tai chi and other movement-based exercise. A Cochrane review in 2017 by Geneen et al., concluded that whilst some evidence is available to support the use of exercise as a method of chronic pain relief, studies are of poor quality due to limited participant numbers (<50) and results were not conclusive,

possibly due to the mix of activities undertaken. Therefore, it is unclear if physical exercise is of benefit to all patients with fibromyalgia.

5.4.2 *Cognitive Behavioural Therapy (CBT)*

Stress is symptom of fibromyalgia and increased levels of stress may correlate with increased pain levels (Bennet et al., 2007). Some evidence suggests that stress is a primary factor in the onset of the syndrome (Furness et al, 2018). CBT therapy, a type of talking therapy that supports individuals to change how they think and behave, may provide coping strategies to manage stress levels and therefore reduce overall pain symptoms but is more effective for female patients due to increased ability to empathise (Lim et al., 2018). Furthermore, no limitations have been seen in CBT delivered via electronic communication (Webb, Joseph, Yardley & Mitchie, 2010), opening up possible treatments for fibromyalgia sufferers who are limited with physical movement (Geneen et al, 2017). A multi-disciplinary, patient centred approach has shown success in reducing overall pain levels in sufferers, suggesting that cognitive, behavioural therapies may be effective in the treatment of fibromyalgia pain (Bourgault et al., 2015).

5.4.3 *Education*

Education both for patients and medical professionals has shown improvements in management of fibromyalgia symptoms (Micheaslon et al., 2005; Musekamp, Gerlich, Ehlebracht-König, Faller, & Reusch 2016). Annemarns et al., (2008) reported that disease diagnosis alone, and the tools provided to manage the condition, resulted in improved symptom management for patients, reducing anxiety by the absence of a lifethreatening condition. Moseley and Butler, (2015) suggest educating medical professionals is key to supporting pain management. Inaccurate diagnosis of fibromyalgia is in part due to a dissimilarity between current International Classification of Diseases (ICD) and criteria-based diagnoses of fibromyalgia (Wolfe et al. 2019). Clinician bias, understanding and the validity of diagnosis are key contributors that prevent disease diagnosis and denial of correct treatment methods (Micheaslon et al., 2005). Clinician education programs aim to use biological understanding of pain to

devise new treatments for pain management (Moseley & Butler, 2015). A focus on the biopsychosocial nature of chronic pain has highlighted the importance of treating psychological implications, where no physical manifestations may be present (Rafaelli & Arnaudo, 2017).

5.5 Role of diet in fibromyalgia

Nutrition plays a key role in health and dietary modification and has been a factor in managing many chronic diseases like obesity, type 2 diabetes and stroke (Schluze, Matinez-Gonzalez, Fung, Lichtestein & Forouhi, 2018). Nutritional studies that quantify the effect of dietary factors on health outcomes may influence dietary guidelines or create change in public health policy (Schoenfeld & John, 2013). The World Health Organisation (WHO, 2004) support the use of diet as a factor in the prevention of noncommunicable disease. Although some studies look at individual micronutrients (Skerrett & Willett, 2010), a methodical approach to dietary patterns suggest that a focus on diet has a wider impact on disease than a single nutrient (Schulze & Hoffman, 2006). Food patterns, the frequency food and drink items are consumed and the portions, diversity, or combination of different foods and drinks in an individuals' diet may give a wider understanding of the effects of nutrition (Leech, Worsley, Timperio & McNaughton, 2015). Modifications, additions and exclusions of macronutrients (proteins, fats and carbohydrates); micronutrients (vitamins and minerals) and combinations of changes can all have an implication on health outcomes in disease (Silva et al., 2012).

There are no current guidelines that support the use of nutritional intervention in fibromyalgia management, despite significant results seen both for pain management and quality of life scores (Holton et al., 2012; Silver & Gebler, 2016). Brian et al., 2019 undertook a meta-analysis of twenty-three intervention studies, that included a nutritional strategy to reduce pain. Participants included adults (>18 years old) who had a history of chronic pain. The authors concluded that nutritional interventions, including vegan and vegetarian diets, exclusion of gluten, low fat and fasting therapy, can be

effective for chronic pain; however, the evidence is limited, varied and in some cases difficult to implement (Brain et al., 2019). Participant adherence to dietary manipulation may be varied and impacted by dietary choice such as food type and quantity or socioeconomic factors such as time, cost and societal demands, often limiting the value of research (Irwin, Desbrow, Khalesi & McCartney, 2019). This is further confounded by the vast array of comorbidities associated with the disease including gastrointestinal, psychological and reproductive complaints (Kaltsas & Tsiveriotis, 2017). Each of these additional concerns often has its own nutritional guidelines which contrast with each other, often leading to further confusion for sufferers.

5.6 Dietary components associated with improvements in pain and symptom targets

5.6.1 Hypocaloric diets

Weight reduction influences improvements in pain, sleep quality and depression symptoms of fibromyalgia (Senna, Sallam, Ashour & Elaman, 2012) suggesting a hypocaloric weight loss plan could lead to potential improvements in symptoms for obese patients, including QOL, depression, sleep quality and tender point count (Senna, et al., 2012). Weight loss was linked to lower levels of interleukin-6 and CRP, both implicated in inflammation and an increase in the anti-inflammatory cytokine Interleukin10 (Schrepf et al., 2017). A 12-week calorie restricted diet (800kcal/day) led to 30% symptom improvement where <10% weight loss was seen in patients with a mean BMI of 40kg/m² (Michealsen, et al, 2013). Weight loss in obese patients has further implications in general health and the management of several potential comorbidities (Timmerman, Calfa & Stuijbergen, 2014).

5.6.2 Gluten free

Gluten free diets involve the removal of dietary wheat, rye, barley and oats (Lewis, Haridy & Newnham, 2017) and is regularly prescribed for patients with coeliac disease (CD). Non-coeliac gluten sensitivity has been identified in patients with fibromyalgia, without a diagnosis of CD (Sapone et al., 2012). Approximately half of patients with gluten sensitivity carry the human leukocyte antigen (HLA) DQ2 or DQ8 heterodimers, in comparison to almost all CD patients (Fry, Seah, McMimm & Hoffbrand 2011).

Symptoms similar to those found in fibromyalgia include chronic fatigue, 'foggy mind', muscle cramps, and joint pain (Troncone & Jabri, 2011). Isasi et al, (2014) found improvements in 22 female patients with fibromyalgia without CD, undertaking a gluten free diet, 15 reporting full remission from all symptoms alongside improvements in depression, gastrointestinal symptoms and fatigue. Furthermore, Isasi et al., (2014) found the presence of intraepithelial lymphocytosis in participants with fibromyalgia but without CD. Intraepithelial lymphocytosis, an increased number of intra-epithelial lymphocytes, a recognised finding in latent coeliac disease (Fry, et al., 2011; Rodrigo et al., 2013), suggests that a gluten free diet may have some benefits in the control of fibromyalgia symptoms in some patients.

5.6.3 *Vegan and Vegetarian Diets*

A vegetarian diet involves excluding animal meat products from an individual's diets, and a vegan diet is the complete exclusion of all animal products including by-products such as honey and dairy (Satija et al., 2017). Kaartinen et al., (2000) explored the effects of a vegan diet on 18 fibromyalgia patients, over three months, against a control group of 15 patients. Improvements were seen in pain levels, joint stiffness and sleep quality, however as a reduction in BMI was also seen, there is a lack of clarity to the actual cause of symptomatic improvement (Shapiro, Anderson & Danoff-Berg, 2005). Azad et al., (2000) concluded that despite a decrease in overall pain scores seen in patients with fibromyalgia undertaking a vegetarian diet, the resulting improvement was less than the use of Amitriptyline, and no other symptomatic improvement was seen, therefore suggesting this diet is of low value to alleviate symptoms. The quality of foods consumed as part of a plant-based diet may vary, refined grains and sugar sweetened beverages may impact on obesity levels known to cause increased pain in the disease (Satija et al., 2017), therefore the quality of a vegetarian or vegan diet should be considered when supporting this intervention.

5.6.4 *Low Carbohydrate/Ketogenic Diets*

Ketogenic diets, primarily consisting of high fat, moderate levels of protein and a very low carbohydrate intake, have been used as an anti-convulsant therapy for seizures, which share physiological symptoms of neuronal excitability with pain (D'Andrea, Romão, Pires do Prado, Krüger, Pires, & da Conceição, 2019). Macronutrient's components of this particular diet are approximately split as >70% fat, and <50g/d carbohydrates, with protein making up the remainder (Ludwig, 2020). Low CHO diets, <10% of total calorie intake, result in a reduction of reactive oxygen species in the brain, seen in rodent models, resulting in a reduction in inflammation (Kim, 2012). With the suggested implication of neuroinflammation effecting fibromyalgia, these changes may result in improved symptoms for patients. A comparative study of 33 women with fibromyalgia following either a western style diet (control group), or a non-ketogenic, low CHO diet (NKLCD) found a positive effect on energy levels and fibromyalgia symptoms in the NKLCD group (Ernst & Shelley-Tremblay, 2013). The level of adherence to the NKLCD was considered but the levels of macronutrient intake was set by the participants and therefore unregulated, so there are several limitations to the authors conclusions. A more robust study would be needed to conclude the benefits of this intervention.

5.7 Individual nutrients that impact pain and symptoms of fibromyalgia

5.7.1 *Vitamin D*

Vitamin D deficiency is prevalent amongst worldwide populations and estimates suggest that almost 50% of people are affected (Nair & Maseeh, 2012). Vitamin D₃ is produced in the skin from exposure to ultra-violet radiation, emitted from sunshine and dietary sources of Vitamin D₃ include oily fish such as salmon, mackerel and tuna (SACN, 2016). Vitamin D deficiency may result in abnormal absorption of dietary calcium and phosphorus, affecting bone metabolism and density (SACN, 2016). Vitamin D also plays a role in immune system regulation, as an active co-factor in multiple sclerosis, type 1 DM, IBS and rheumatoid arthritis (Plotnikoff, & Quigley, 2003; Atherton et al, 2009). Olama et al. (2013) and Okyay et al., (2016) linked vitamin D deficiency with increased pain scores (measured using the VAS scale), and depression scores in premenopausal

women with fibromyalgia. Furthermore, Okyay et al., (2016) and Altindag et al., (2014) report a correlation between lower QOL scores and decreased vitamin D levels using FIQR. A randomized control trial comparing Vitamin D supplementation (150,000 IU vitamin D₃, oral) with placebo, over 6 weeks, found significant reductions in pain in the treatment group, an effect that was magnified over the treatment period (Schreuder, Bernsen & van der Woulden, 2012). This suggests that vitamin D deficiency may play a role in several symptomatic controls for the disease.

5.7.2 *Magnesium*

Magnesium (Mg) plays a role in enzymatic reactions and intracellular physiological functions (Grases et al., 2006). Deficiency in Mg may lead to disorders of the neuromuscular, cardiac or nervous system (Jahnen-Dechent & Ketteler, 2012). Green vegetables, nuts, seeds, and unprocessed cereals are rich sources of magnesium (Costello, Wallace & Rosanoff, 2016). Common side effects of hypomagnesemia include muscle weakness, cramps and increased sensitivity of the nervous system (Grober, Schmidt, & Kister, 2015). Magnesium deficiency plays a role in psychiatric symptoms, including depression, although the action of magnesium is not currently understood, it is hypothesised that magnesium effects oxidation reduction and ionic regulation in the brain, leading to a reduction in depressive symptoms (Serefko et al., 2013; Eby, Eby & Murk, 2011). Furthermore, acute stress leads to excretion of Mg through activation of the HPA axis (Grases et al., 2006). Kasim (2017) found significantly lower serum levels in five Iraqi women with fibromyalgia, and Engen et al., (2015) found improvements in scores on the Fibromyalgia Impact Questionnaire on a four-week feasibility study with transdermal magnesium spray. However, a cross sectional study by Sakarya, et al. (2011), found no significant differences in serum Mg levels between patients with fibromyalgia and healthy controls. RCTs exploring the impact of magnesium on patients with fibromyalgia are limited, with participant numbers less than 100 (Joustra et al., 2017). Larger studies may support a better understanding of the impact magnesium has on the disease.

5.7.3 Calcium

Calcium and magnesium have closely related metabolic properties (King, 2009). Like magnesium, calcium has been connected with symptoms and pain in fibromyalgia (Andretta, et al 2019). Kim et al., (2011) compared the hair minerals of females with fibromyalgia with a control group and found significantly lower levels of calcium, as well as magnesium and iron. However, Andretta et al., (2019) reported no difference in serum calcium levels between participants with fibromyalgia and their control group but did highlight substantially lower intakes of dietary calcium. However, this calcium intake was positively correlated to pain threshold, suggesting that lower dietary intakes of calcium may impact on pain in the disease. A review and meta-analysis by Joustra et al. (2017), identified 1 RCT for fibromyalgia and calcium intake, however the study quality was ranked as poor and no clinical improvements were seen with supplementations, suggesting further, more robust RCTs may be required.

5.7.4 Iron

There is a suggested association between ferritin levels and the prevalence of fibromyalgia (Ortancil, et al, 2010). Furthermore, fibromyalgia has been shown to be more prevalent in individuals with iron deficiency anemia (Pamuk et al, 2008). Animal models have linked iron-deficiency with a reduction in pain threshold and increases in pain sensation (Dowling et al., 2009). Additionally, iron deficiency, without the presence of anemia has been linked with weakness, fatigue and difficulty concentrating, pathophysiology seen in fibromyalgia (Soppi, 2018). A double blinded, randomized control trial in 2017 by Boomershine, Kocj and Morris found improvements in fibromyalgia symptom severity in comparison to placebo when supplementing with ferric carboymaltose at 15 mg/kg, over a period of 42 days, suggesting iron may play a role in disease severity.

Despite specific study examples both epidemiological and RCTs, a meta-analysis, of 5 RCTs and 40 observational studies by Joustra et al., (2017), reported no evidence to support the hypothesis that deficiencies in vitamins and minerals play a role in the

pathophysiology of fibromyalgia, so further research is required to understand the role both in the disease and as a part of wider dietary intake.

5.8 Patient led dietary manipulations

Disordered eating patterns alongside gastrointestinal dysfunction are more common in patients with fibromyalgia than healthy adults (Silva et al., 2012; Slim, Calandre & Viladermros, 2015). Patients are often influenced by information found via online sources, often non-scientific in basis, often due to a lack of sources from medical professionals (Arrenz, Canela & Rafecas, 2010). Imbalances in nutritional status are reported amongst patient groups (Rossi et al, 2015). A plethora of research suggests benefits of following nutrition-based interventions for symptomatic improvement in both fibromyalgia and gastrointestinal dysfunction (Silva et al., 2012). However, dietary changes which are mediated by negative symptomatic reactions to specific food groups, often lead to exclusion of dietary components. These changes are rarely undertaken on the basis of evidence-based practice or professional advice but more commonly on the advice of other individuals with the disease (Arrenz, Canela & Rafecas, 2012; Bennet, 2007; Lopez-Rodriguez, Molina, Medina, Sola & Muelle, 2015; Morris, Bowen & Morris, 2005). The sources accessed to guide these dietary changes are often unclear.

Self-medication is commonly seen in fibromyalgia. A study by Wahner-Roedler et al., (2005), reported 98% of outpatients attending a fibromyalgia clinic had used alternative therapy, not prescribed by a medical professional, including dietary therapy, physical relaxation techniques and exercise. A Facebook group poll by Bowden (2019), in the UK Fibromyalgia Private group resulted in 419 responses with 18 nutritional triggers for fibromyalgia (appendix B). Of these 15.27% suggested aspartame was responsible for making their symptoms worse, 13.37% suggesting refined carbohydrates, understood as; white flour, white bread, white rice, pastries and biscuits and 11.22% suggesting alcohol is the cause. There was no indication of the number of participants to this poll, however the number of potential causes does indicate that suffers of fibromyalgia

themselves have a wide range of concerns with nutritional intake and limited advice to follow.

Despite continued research there is still confusion in both the diagnosis and treatment of fibromyalgia (Bidari, Parsa, Ghalehbaghi, 2018). Patients often suffer with a range of symptoms and co-morbidities meaning treatment must be multi-model and flexible to changes in disease state (Wolfe et al., 2019). A lack of change in pain levels means patients often see no improvements in quality-of-life markers (Micheaslon et al., 2005). Lack of patient satisfaction in medical led treatments results in the growth of anecdotal evidence (Mazanderani, Locock & Powell, 2012). Non-pharmaceutical treatments based on nutrition have been found to show some improvements, but the range of suggestions leads to continued confusion for patients (Shao et al, 2017). Furthermore, these interventions lack sufficient evidence from randomized controlled trials to establish efficacy (De Silva, El-Metwally, Ernst, Lewith & Macfarlane, 2010). Understanding the role patient led changes in diet has on pain levels in conjunction with food frequency may lead to better understanding and more patient led treatments for fibromyalgia.

6 Aims and objectives

The effect of diet on fibromyalgia symptoms is not widely researched but a frequent topic discussed in social media groups. This guidance is often unregulated, and, in some cases, dietary restrictions may result in negative health outcomes. This project aims to explore the association between dietary choices, including food and nutrient types, quantity and quality, and pain and symptoms in individuals with fibromyalgia. This research will use a series of validated tools to investigate the relationship between reported dietary intake, dietary quality, anthropometric measurements and specific nutrients on pain and symptoms for individuals with fibromyalgia.

The specific objectives are:

1. Elucidate the link between diet quality and fibromyalgia symptoms.

2. Investigate the association between nutrient intake and fibromyalgia symptoms.
3. Explore any self-reported impact of dietary changes on fibromyalgia.

7 Materials and Methods

This cross-sectional study used an online survey to assess the impact of diet on fibromyalgia symptoms in adults (aged > 18 years) with fibromyalgia. The study protocol was approved by the Health, Science, Engineering & Technology ECDA, at the University of Hertfordshire (protocol number LMS/PGR/UH/03765).

7.1 Subjects

Participants were recruited via social media platforms including Facebook, Instagram and Twitter between March and October 2019. Four international fibromyalgia support groups were identified on Facebook and members were invited to complete the study. All participants provided informed consent via the online survey platform (Qualtrics). Participants in the study were required to meet the following inclusion criteria: 1) Must be over the age of 18 years, 2) Must suffer from fibromyalgia (medical or self-diagnosis) which was assessed via a screening questionnaire.

7.2 Study design

The online survey was launched in March 2019 and ran for a period of 6 months. A link to the survey was included in the adverts posted on social media pages on Facebook, Twitter and specific support groups for fibromyalgia. Participants first completed consent, which assessed eligibility. Those undertaking the survey were asked to complete validated questionnaires for pain and symptom assessment, and dietary intake. Participants were also instructed to provide self-recorded height (m) and weight (kg). Further questions assessing comorbidities, including depression and anxiety, prescribed medication, dietary changes and dietary sources of information were also included. Participants who responded positively to having manipulated their dietary

intake in order manage fibromyalgia symptoms, were asked to provide details on these including where they obtained information to make these decisions.

7.3 Pain and symptom assessment

Pain and symptom assessment were undertaken using the validated Revised Fibromyalgia Impact Questionnaire (FIQR) (Bennett et al., 2009). The FIQR tool requires the respondent to report pain and symptoms over a previous seven-day period, via a Likert scale. The responses indicate the difficulty in completing specific activities over 3 domains that assess for physical limitations, pain levels and mental wellbeing. All questions are graded on a 0–10 numeric scale. The final score across the 21 questions ranges from 0 to 100, weighted 30% to function, 50% to symptoms and 20% to overall impact and provides a subjective response to the impact fibromyalgia has on an individual's lifestyle in the absence of objective validated tools.

7.4 Dietary Assessment

The, semi-quantitative, validated European Prospective Investigation into Cancer and Nutrition Norfolk Food Frequency Questionnaire (EPIC-Norfolk FFQ), version 6 (CAMB/PQ/6/1205) was used to estimate participants usual food intake during the previous year in two parts. Part one asked participants to indicate their usual rate of consumption for 130 foods or food types in nine frequencies: never or less than once a month, 1–3 times a month, once a week, 2–4 times a week, 5–6 times per week, once a day, 2–3 times per day, 4–5 times per day, and 6+ times per day. Part two included additional questions on brand and type of cereal, fat, milk, cooking methods and eating habits based on responses in part 1. These additional questions allow the software to calculate total fat and fatty acid consumption. Data were analysed using FETA (Φετα) to produce nutritional information at both macro and micronutrient level, for each participant (Mulligan et al., 2014). Participants were provided with instructions on how to complete the FFQ (Appendix B).

7.5 Diet Quality Score

Diet quality score was assessed from the completed FFQs. The Healthy Eating Index

(HEI) assesses an individual's dietary intake against suggested guidelines by the Dietary Guidelines for Americans (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2015). Each dietary group is provided with a minimum (0) or maximum (5 or 10) score based on cup equivalent and ounce equivalent portions and their positive or negative effects on health outcomes or adherence to recommendations. HEI categories in red are negatively associated to HEI score. Data is energy adjusted per 1000kcal intake or % energy.

Healthy Eating Index, 2015 (HEI, 2015) were calculated for each participant based on their FFQ. The HEI includes 13 component food groups, including (1) total fruit; (2) whole fruit; (3) total vegetables; (4) greens and beans; (5) whole grains; (6) dairy; (7) total protein foods; (8) seafood and plant proteins; and (9) fatty acids. The final four components should be consumed in moderation (10) refined grains; (11) sodium; (12) added sugars and (13) saturated fat and are therefore scored negatively. The range of points per component varies between 0-5 and 0-10 (fruit, vegetable and protein components, five points; remainder 10 points) and the 13 components are totalled to produce a total maximum score of 100 (Krebs-Smith et al., 2018). Fatty acid total in the HEI is calculated by the addition of polyunsaturated fats and monounsaturated fats divided by saturated fatty acids.

7.6 Depression and Anxiety

The Patient Health Questionnaire (PHQ) is a self-administered diagnostic instrument for common mental disorders, also used in primary care and a reliable and valid measure of depression severity (Kroenke, Spitzer, & Williams, 2001). The tool uses 4 response frequencies (Not at all; Several days; More than half the days and nearly every day) to measure a score out of 27 that rates levels of depression (Depression Severity: 0-4 none, 5-9 mild, 10-14 moderate, 15-19 moderately severe, 20-27 severe). Scores above 4 are medically recognised as a depression diagnosis.

Generalized Anxiety Disorder 7 (GAD-7) is a self-reported questionnaire for screening and measuring severity of generalized anxiety disorder (GAD). GAD-7 is a series of

seven questions to measure the severity of GAD according to reported response categories (Spitzer, Kroenke, Williams, & Löwe, 2006). It uses the same 4 frequencies as the PHQ-9 tool, with overall measures out of 21 (Anxiety Severity: 0-4 none, 5-9 mild, 10-14, moderate, 15-21 severe).

7.7 Anthropometric measurements

Self-reported anthropometric measurements weight (kg) and height (m) were used to calculate participants BMI. Participants were provided with instructions to complete these measures for reporting consistency.

7.8 Assessment of self-reported dietary change

Self-reported dietary change was assessed via multiple-choice questions to ascertain the type of diet change, impact on pain and evidence sources. The survey asked participants to report total pain out of 10 before dietary change and after. This allowed participants to identify individual nutrients or food groups and score them independently. Respondents were asked to indicate the ease at which these changes have been maintained via open-ended comments (appendix B).

7.9 Statistical analysis

Data are shown as means +/- SD. Outcome measures were normally distributed with outliers excluded for energy. Participants reporting a daily energy intake greater than 4500 kcal, which is considered implausibly high, were excluded from the analysis (Herbert et al., 2001). Gender-based differences in age, weight (kg), BMI (kg/m^2), FIQR, PHQ-9 and GAD-7 were analysed using independent samples t-test.

The association between pain and symptoms, and BMI and energy, were evaluated using 1) Pearson's Rank correlation coefficients and 2) ANOVA (with post-hoc Bonferroni tests) following the separation of participants into quintiles based on their FIQR score; models were adjusted for gender (where significant).

To assess the association between pain and symptoms, and diet quality and adherence to dietary reference values, participants were separated into dichotomous groups,

representing low (<49) and high (>49) FIQR scores. Independent samples t-test was used to analyse HEI component scores. Chi-squared tests were used to assess dietary reference values and the participant adherence to nutrient intake targets. Previous research suggests that the nutrients magnesium (Mg), vitamin D, calcium (Ca), iron (Fe), sodium (Na⁺) and vitamin B12 have an association with the pain and symptoms of fibromyalgia (Altindag et al., 2014; Okyay et al., 2016; Andretta et al, 2019). Questions in domain 3 of the FIQR tool can independently score for energy levels and quality of sleep. We used these questions to additionally, investigate the association of Magnesium with fatigue measures, as evidence has suggested that low intakes of Mg may be associated with lethargy (Kirkland, Sarlo & Holton, 2018; Andretta et al., 2019). A one-way analysis of variance (ANOVA) was conducted to ascertain if there is an association between meeting dietary reference values for magnesium and increased scores for these criterium. Participants were divided into 3 groups based on their vitamin D intake (Group 1: <2ug, Group 2: 2-5ug, Group 3: >5ug). ANOVA was conducted to explore the impact of vitamin D consumption on FIQR score. Reported pain scores before and after specific food or food group modification were assessed using an independent samples t-test.

A p-value of <0.05 was considered statistically significant. Data were analysed using SPSS, version 25 (IBM Corp, 2017).

8 Results

8.1 Participant characteristics

In total, 414 participants registered for the study, 381 (92%) completed the survey in full (86.9% female). The majority of participants were UK residents (97.4%), (USA n=4: Egypt, Australia, Malaysia and New Zealand n=1) with a confirmed diagnosis of fibromyalgia from a medical professional (95.5%). Baseline characteristics of participants as a total group and per gender are shown in **Table 2** for age, weight, weight status (BMI), total FIQR, GAD-7 and PHQ-9 score.

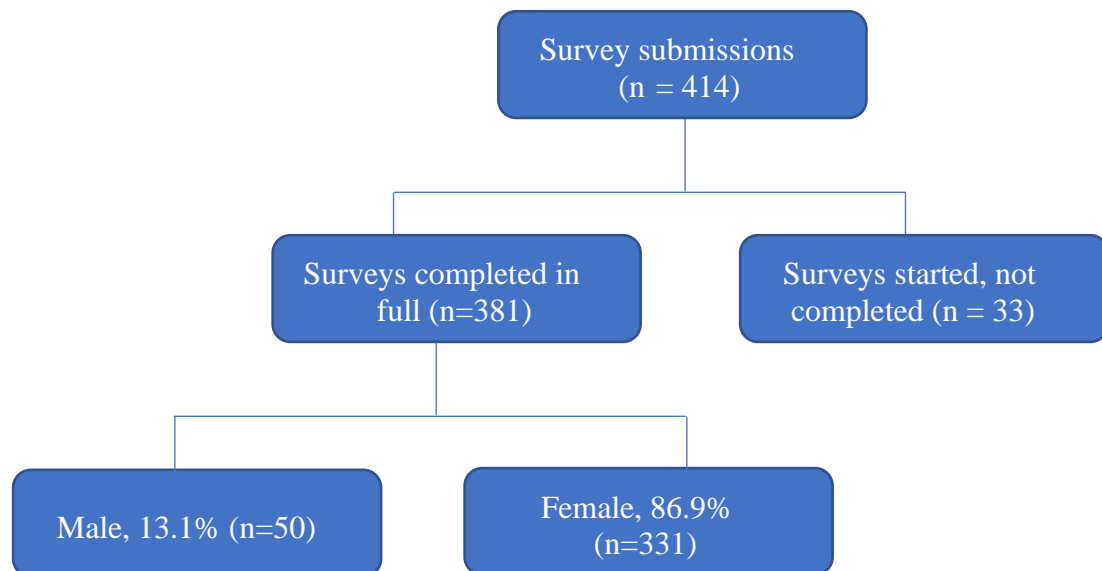


Figure 1. Selection of participants for study participation.

The mean age and self-reported weight of male participants was significantly higher than females (p 's<0.005). With regard to pain and symptom scores (FIQR), females reported 33% higher scores than males (p <0.001). There were no significant differences in BMI, depression or anxiety scores between males and females.

Table 2. Participant characteristics (n=381) and characteristics per gender for males (n=50) and females (=331).

	All participants		Male		Female		¹ P value
	Mean	SD	Mean	SD	Mean	SD	
Age	44	13.65	48	11.73	43	13.84	.033
Weight kg	81.23	18.67	87.49	16.07	80.34	18.88	.011
BMI kg/m ²	30.3	7.01	28.8	6.05	30.5	7.13	.121
Underweight (<18.49kg/m ² ,%)	4.5		0.0		5.1		
Healthy Weight (<18.5-24.99kg/m ² , %)	19.2		24		18.4		
Overweight (<25- 29.99kg/m ² , %)	26		46		23.3		
Obese (<30-39.99kg/m ² , %)	42.3		24		45.0		
Morbidly obese (>40kg/m ² , %)	8		6.0		8.2		
FIQR	50.19	19.89	35.14	13.76	52.46	19.70	<.001
GAD-7	8.40	5.53	9.66	5.24	8.21	4.84	.052
PHQ-9	9.91	4.91	10.64	4.96	9.80	5.61	.316

Data is presented as means +/-SD.

¹Data analysed using independent samples T-test

FIQR – Revised Fibromyalgia Impact Questionnaire

GAD-7 – General Anxiety Disorder Assessment

PHQ-9 – Patient Health Questionnaire

In total, 73% of participants reported additional co-morbidities alongside their fibromyalgia, with some reporting multiple conditions. The spread of self-reported comorbidities is presented in **Figure 2**. Each disease category is represented using a different colour, with specific conditions indicated by boxes. The larger boxes represent a larger reported sample. The majority of additional health concerns were reported as mental health (26.5%), gastrointestinal (16.8%) and muscular-skeletal symptoms (17.1%). Cancer, liver disease, hyperthyroidism and kidney disease appeared only once in the participant survey.

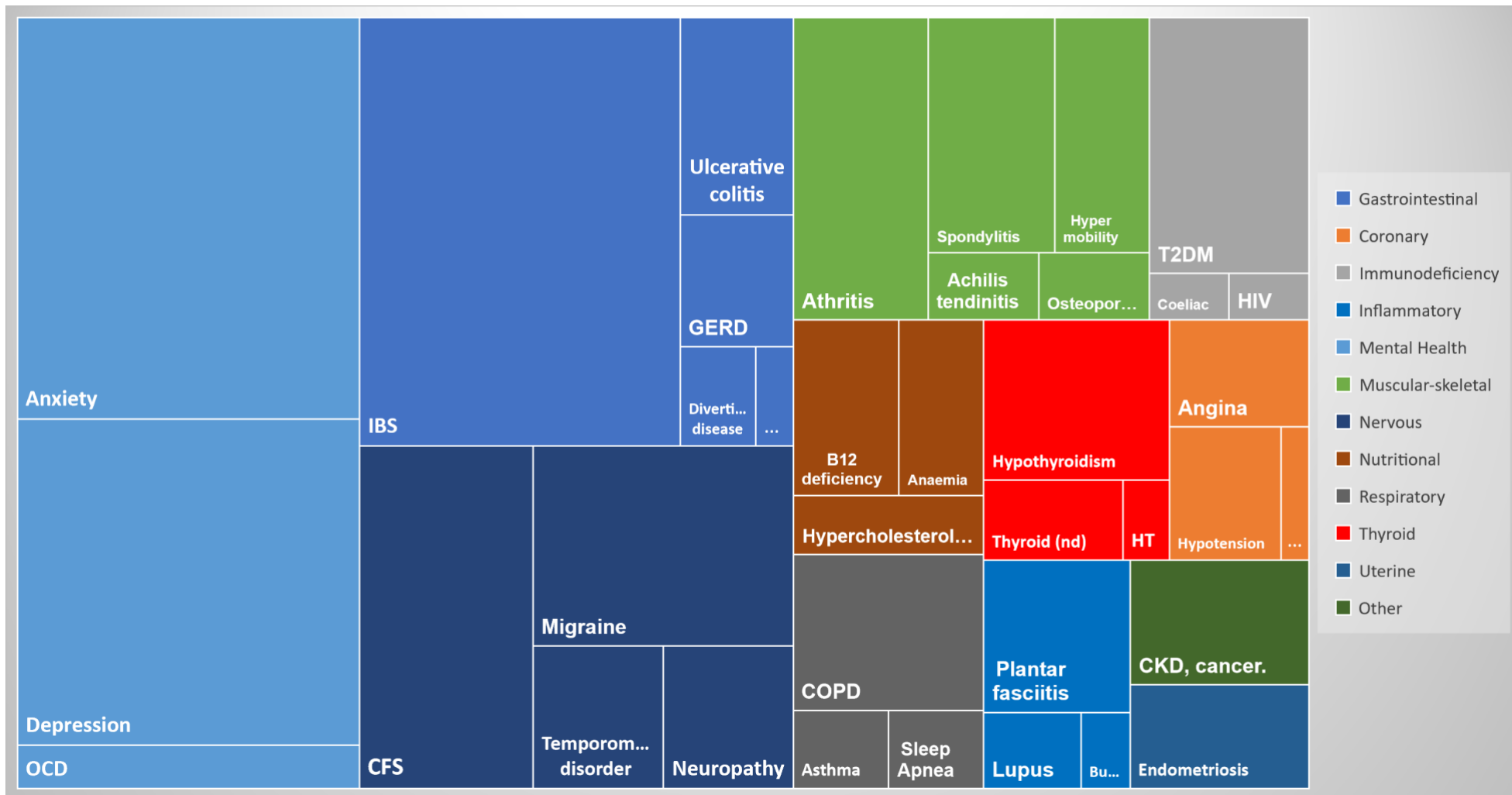


Figure 2. Frequency of reported co-morbidities (n=279).

Data are presented as sample numbers. Each coloured box represents a disease category, with specific medical conditions extrapolated.

OCD -Obsessive Compulsive Disorder; CD - Crohn's Disease; CFS - Chronic Fatigue Syndrome; T2DM - Type 2 diabetes mellites; HIV - Human Immunodeficiency Virus; HT - Hyperthyroidism; HN – Hypertension; IBS – Irritable Bowel Syndrome

Table 3 describes the total number of prescriptions per drug classification reported by the participant group. In total, 61% (n=231) of participants reported medication prescribed specifically for the treatment of fibromyalgia. The majority (72.3%) reported a single prescription for fibromyalgia, with the remainder reporting multiple medications (maximum of 4). The most common prescription was antidepressants (72.4%) with others for pain management (26.3%), nutrition (1%) and non-classified medications (0.3%). Of the drug class antidepressants, the most prescribed were tricyclic antidepressants (TCAs, 43%), including amitriptyline (n=125) and Imipramine (n=1), and serotonin and norepinephrine reuptake inhibitors (SNRIs, 14%), including Duloxetine (n = 30), Milnacipran (n=12) and Paroxetine (7). Gabapentinoids (14%), including Pregabalin (n=30) and Gabapentin (n=11), and opiates (8.2%), including Tramadol (n= 18) and Codeine (n = 6), were the most commonly prescribed pain relievers. Nutritional supplements accounted for only 1% of all prescribed medication, which included Vitamin D (n=2) and Ferrous Sulphate (n = 1) for iron deficiency.

Table 3 Participant self-reported prescriptions by drug classification.

Drug Classification	Total	%
TCAs	126	43
SNRIs	45	15.4
Gabapentinoids	41	14
Opiates	24	8.2
TeCAs	21	7.3
SSRIs	20	6.8
Glucocorticoids	6	2.0
Supplements	3	1.0
NSAIDs	3	1.0
Analgesics	2	0.7
Skeletal muscle relaxant	1	0.3
Antihistamines	1	0.3

TCAs – tricyclic antidepressants
SNRIs - Serotonin and norepinephrine reuptake inhibitors
SSRIs - Selective serotonin reuptake inhibitor
TeCAs - Tetracyclic antidepressants
NSAIDS – Non-steroidal anti inflammatory

8.2 Association between fibromyalgia symptoms, BMI and energy intake

The relationship between fibromyalgia symptoms, and BMI and energy were evaluated using Pearson product-moment correlation coefficient. There was a strong positive correlation between the variables BMI and FIQR, ($r = .63$, $p < 0.001$) and a small positive correlation between energy intake and FIQR ($r = .28$, $p = < 0.001$)

The results in **Table 4** show the mean BMI and energy intake (kcal) according to quintiles of FIQR score. A significant association was observed for both variables ($P < 0.05$) (**Table 3**). BMI was significantly higher in Q3, Q4 and Q5 than Q1. BMI scores for participants in Q4 and Q5 were significantly higher than all other quintile groups. A significantly higher energy intake was seen in Q3, Q4 and Q5 when compared with Q1 and Q2.

Table 4. Association between pain and symptoms (FIQR score), BMI and self-reported energy (kcal) intake.

	Q1 <31 (n=83)		Q2 32 - 44 (n = 70)		Q3 45 - 55 (n = 77)		Q4 56 - 69 (n=78)		Q5 70+ (n=73)		P-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
BMI	25.3 ^{c-e}	4.76	26.4 ^{d,e}	4.73	28.9 ^{a,d,e}	6.11	33.8 ^{a-c,e}	5.44	37.7 ^{a-d}	5.65	<.001
Energy intake (kcal)	1874 ^{h-j}	776.11	1842 ^{h-j}	627.38	2177 ^{f,g}	803.85	2221 ^{f,g}	865.86	2415 ^{f,g}	958.83	<.001

Data is presented as means +/- SD. Data analysed using one-way analysis of variance, significant at $P < .05$. Post hoc analysis using Bonferroni. Data were split into quintiles.

BMI post-hoc analysis ^astatistical significance with Q1, ^bstatistical significance with Q2 ^c statistical significance with Q3, ^dstatistical significance with Q4, ^eStatistical significance with Q5

Energy intake post-hoc analysis ^fstatistical significance with Q1, ^gstatistical significance with Q2, ^hstatistical significance with Q3, ⁱstatistical significance with Q4, ^jstatistical significance with Q5

The impact of BMI on pain and symptoms (FIQR) was further explored by analysing the percentage of participants in each quintile group in relation to their BMI group. **Figure 3** shows the total number of participants in each BMI classification per FIQR quintile. Underweight participants were the majority in Q3 (35.3%) with a similar sample in Q1 (29.4%) and Q2 (23.5%). The majority (>80%) of individuals with a healthy BMI had low FIQR scores (Q1,59%; Q2,24.5%). Overweight participants reported FIQR scores predominantly in Q2 (37%), Q3 (27%) and Q1 (24%). However, 36% of obese participants (30-39.99kg/m²) reported FIQR scores between 56-69 (Q4) and 29.8%

above 70 (Q5), indicating higher pain and symptom scores. Similarly, morbidly obese participants ($>40\text{kg/m}^2$) had scores predominantly in Q5 (63.3%).

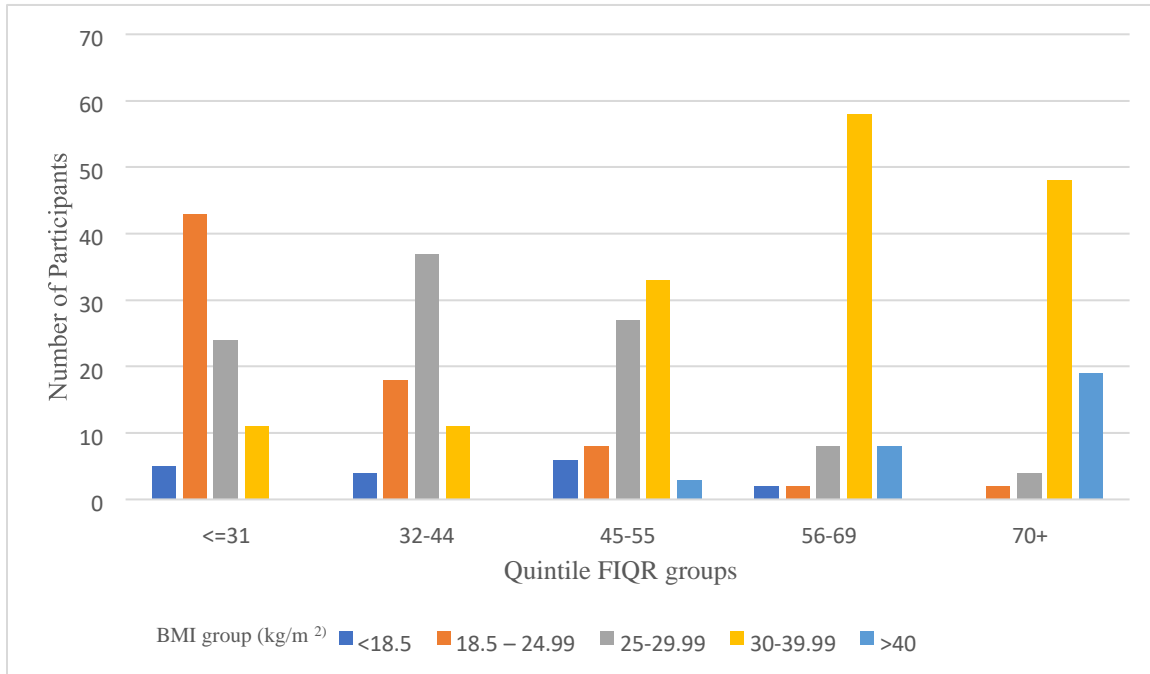


Figure 3. Association between pain and symptoms (FIQR score) and participants BMI weight classification.

Data presented as participant numbers per BMI category. Underweight ($<18.49\text{kg/m}^2$), Healthy Weight ($<18.5-24.99\text{kg/m}^2$), Overweight ($<25-29.99\text{kg/m}^2$), Obese ($<30-39.99\text{kg/m}^2$), Morbidly obese ($>40\text{kg/m}^2$).

Data were separated into quintiles according to FIQR score.

8.3 Association between fibromyalgia symptoms and diet quality

The relationship between fibromyalgia symptoms and diet quality, assessed using the healthy eating index (HEI), were evaluated using Pearson product-moment correlation coefficient, with a small negative correlation observed between FIQR and total HEI score ($r = -0.13$, $p = 0.002$). The mean scores for the HEI and HEI components are shown in **Table 5**; participants were divided into dichotomous groups based on the median FIQR score. **Figure 4** shows the percentage of total points received for each component score on a radar plot, with 100% indicating a perfect score.

	Total group (n = 381)	SD	Low FIQR (n=191)	SD	High FIQR (n=190)	SD	¹ P
HEI	49.43	9.89	49.95	10.07	48.90	9.70	.299
Total fruit ²	3.09	1.67	3.30	1.60	2.88	1.71	.014
Whole fruits ³	3.78	1.63	3.98	1.50	3.57	1.73	.016
Total Veg ⁴	3.36	1.49	3.48	1.44	3.23	1.54	.108
Green and beans ⁴	4.31	1.16	4.41	1.07	4.22	1.24	.119
Whole grains	6.41	4.25	6.65	4.16	6.17	4.34	.268
Dairy ⁵	1.33	1.24	1.52	1.38	1.13	1.04	.002
Protein ⁴	3.06	0.80	3.21	0.90	2.91	0.65	<.001
Seafood and plant proteins ^{4,6}	0.67	0.85	0.71	0.75	0.63	0.86	.370
Fatty Acids ⁷	1.07	2.51	1.50	2.98	0.63	1.84	.001
Refined Grains ⁸	4.20	4.57	4.72	4.64	3.68	4.46	.025
Sodium ⁸	5.59	2.78	5.66	2.89	5.52	2.65	.612
Added sugars ⁸	9.33	1.77	9.49	1.57	9.17	1.94	.082
Saturated fats ⁸	3.24	2.97	3.65	3.05	2.84	2.83	.007

Data is presented as means +/-SD.

¹Data analysed using independent samples t-test, significant at $P < .05$.

Data were dichotomised according to median FIQR score, 49. Data is energy adjusted per 1000kcal intake or % energy. Intakes between the minimum and maximum standards are scored proportionately.

²Includes 100% fruit juice.

³Includes all forms except juice.

⁴Includes legumes (beans and peas).

⁵Includes all milk products, such as fluid milk, yogurt, and cheese, and fortified soy beverages.

⁶Includes seafood; nuts, seeds, soy products (other than beverages), and legumes (beans and peas).

⁷Ratio of poly- and mono-unsaturated fatty acids (PUFAs and MUFAs) to saturated fatty acids (SFAs).

⁸Moderation components, **higher** scores reflect **lower** intakes

The Healthy Eating Index (HEI) assesses an individual's dietary intake against suggested guidelines by the Dietary Guidelines for Americans (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2015). Each dietary group is provided with a minimum (0) or maximum (5 or 10) score based on cup equivalent and ounce equivalent portions and their positive or negative effects on health outcomes or adherence to recommendations. HEI categories in blue are negatively associated to HEI score.

An independent t-test was undertaken to evaluate the difference in HEI scores according to dichotomous FIQR groups. Participants with lower pain scores (FIQR <49) scored significantly higher across 7 out of 11 components (**Table 5**). Whilst there was no significant difference in overall HEI, participants with lower FIQR scores had significantly higher intakes of total fruits ($p=0.014$), whole fruits ($P=0.016$), dairy ($P=0.002$), protein ($P<0.001$) and fatty acids ($P=0.001$). Similarly, significantly lower intakes of the moderation components refined grains ($P=0.025$) and saturated fats ($p=0.007$) were seen in participants reporting lower fibromyalgia symptoms, when compared with those reporting higher levels of pain.

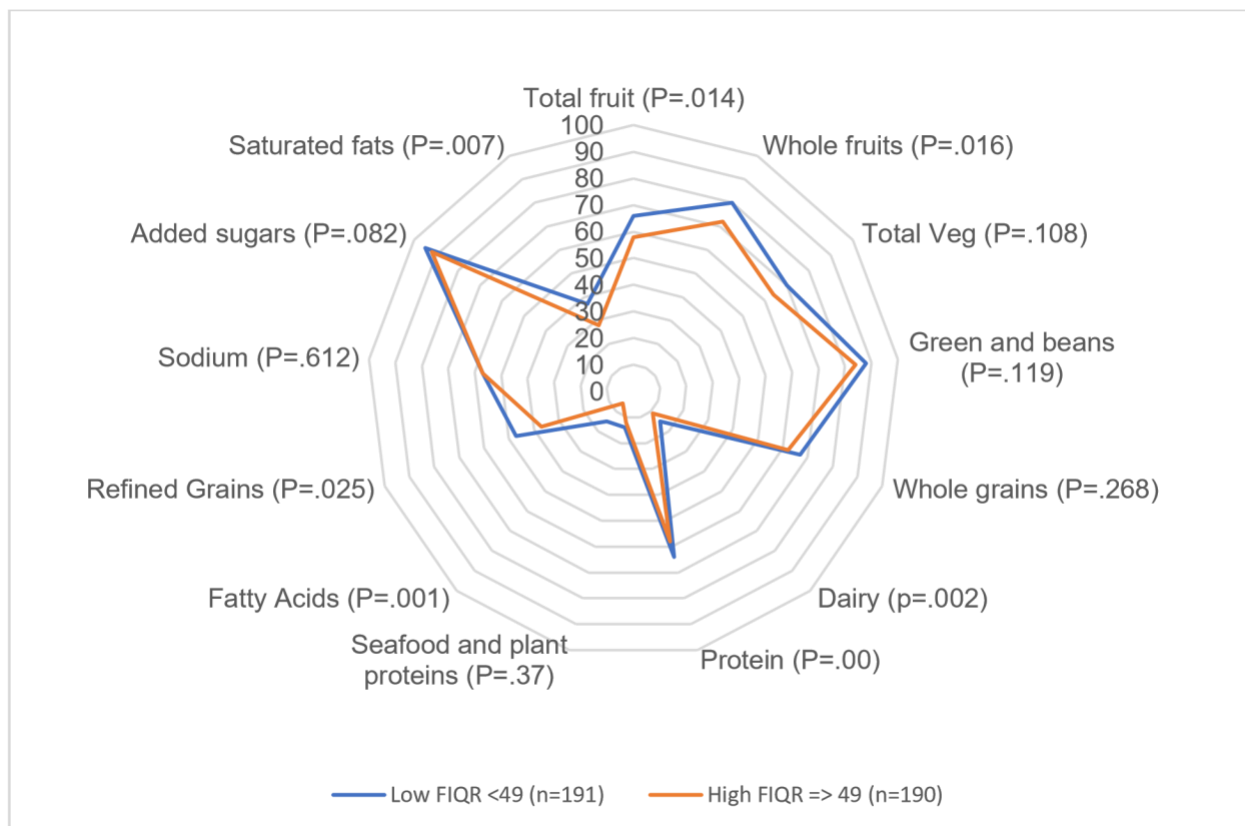


Figure 4. Association between pain and symptoms (FIQR score) and HEI score parameters.

Radar plot showing HEI-2015 scores for low FIQR scores (n=191) and high FIQR scores (n=190). The outer wheel represents the maximum adherence to dietary guidelines (100%) for each component, whilst the center of the circle represents the minimum score (0%). The majority of components represent higher scores with higher consumption, whereas moderation components; saturated fat, sodium, added sugars and refined grains are inversely scored (higher scores = lower consumption). Differences in HEI-2015 components were analysed using independent samples t-tests. P values transposed from table 5.

8.4 Association between fibromyalgia symptoms and nutrient intake

Figure 5 represents the percentage of participants meeting their dietary reference values (DRVs) for selected micronutrients, in relation to their dichotomous FIQR group.

A significantly higher number of participants with high FIQR scores met their dietary reference values for iron intake than those participants with lower scores (P=.018). However, no significant results were noted for calcium, B12, Mg or Na+ intake between these groups. No significance was seen for energy scores or rested scores between participants meeting and not meeting their DRVs for dietary magnesium.

There was a statistical difference between vitamin D groups ($p < 0.001$). In total, 38.8% ($n = 147$) of participants reported a mean dietary intake of vitamin D between 2-5ug, with 14.2% ($n = 54$) exceeding this. Between group means suggest significantly higher intakes of Vitamin D in group 2 (2-5ug Vitamin D/day) (3.22 ± 0.78 SD) than group 1 (<2ug vitamin D/day) ($M = 1.42 \pm 0.43$ SD), however there was no statistically significant difference in mean Vitamin D intake between group 3 (>5ug Vitamin D/day) ($M = 5.97 \pm 0.82$ SD) and the other groups.

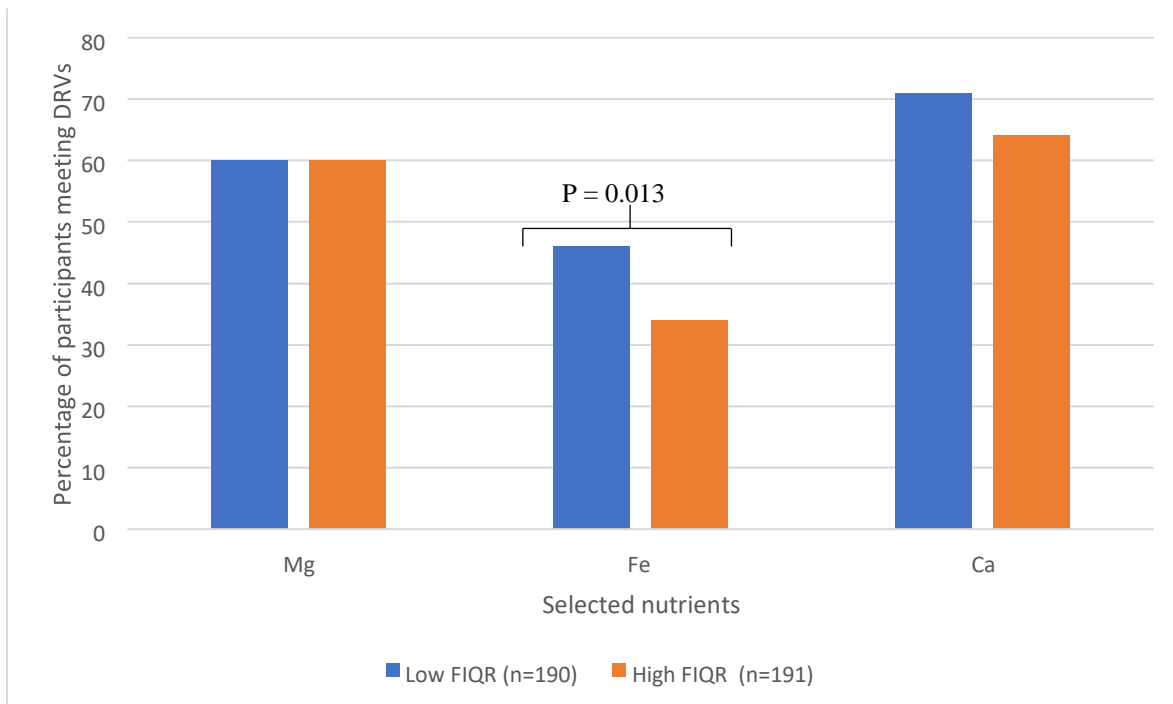


Figure 5. Percentage of participants meeting recommended dietary reference values (DRVs) for selected nutrients, according to pain and symptoms (FIQR score), ($n = 381$). *Dietary reference values (DRVs) per gender and age group for adults (PHE, 2018). Data were analysed using chi squared test. Significance was only seen in iron intakes.*

The data in **Table 6** describes macronutrients and micronutrients, with no previous clear link to fibromyalgia. The data displayed is for participants who are meeting DRVs for these nutrients, separated into dichotomous groups based on FIQR score. Participants with high pain and symptom scores (FIQR) were more likely to meet or exceed recommended dietary intakes for carbohydrates than those with lower scores ($p = 0.019$). No statistical significance was seen between groups for other recorded micro or macro nutrients.

Table 6. percentage of participants meeting DRVs for nutrients (not selected) per dichotomous groups adjusted for gender and age.

Nutrient	v FIQR<49 (n=191)	FIQR =≥49 (n=190)	P ¹
Protein (g)	91.9	92.6	0.719
CHO (g)	20.9	32.1	0.019
Total fat (g)	51.8	44.2	0.166
Ascorbic Acid (mg)	94.8	96.3	0.628
Calcium (mg)	68.6	65.8	0.637
Chlorine (mg)	80.1	86.3	0.138
Cobalamin (mcg)	96.9	94.2	0.316
Copper (mg)	49.2	49.5	1
Iodine (mcg)	31.4	37.9	0.222
Niacin (mg)	90.1	90.5	1
Phosphorus (mg)	100	100	1
Potassium (mg)	37.7	47.4	0.071
Pyridoxine (mg)	90.6	94.7	0.174
Retinol equivalents (mcg)	26.7	20.5	0.194
Riboflavin (mg)	84.3	86.3	0.680
Selenium (mcg)	40.3	46.8	0.237
Sodium	85.1	84.3	0.576
Thiamine (mg)	92.7	95.3	0.397
Total Folate (mcg)	71.2	76.8	0.255
Zinc (mg)	68.1	74.7	0.184
Vitamin B12	94.2	97.0	0.314

Data presented as the percentage of participants meeting recommended dietary reference values (DRVs).

¹*Data analysed using chi-squared test.*

Continuity correlation used for statistical significance, table size 2x2.

8.5 Self-reported impact of dietary changes on fibromyalgia

The results in **Table 6** describe the mean and SD for FIQR, energy and BMI for participants who did not report dietary modification (primary dataset) and those who did self-report dietary modifications (sub-group). Significant differences were seen between the primary group and subgroup (self-reporting dietary change) in FIQR score, energy intake and BMI. There overall mean pain and symptom (FIQR) score was 9.24 points lower in this sub-group in comparison to those who did not report change ($P<0.001$). Furthermore, there was a significantly lower overall calorie intake (-441, $P<0.001$) and BMI (-4.04kg/m², $P<0.001$) in the self-reported dietary modification group compared to the primary group.

Table 7. Mean FIQR, energy and BMI scores and the change for the primary group (n=330) and subgroup with self-reported dietary change (n=51).

	Primary (n=330)		Subgroup (n = 51)		Difference in mean	P
	Mean	SD	Mean	SD		
FIQR	51.6	19.78	42.33	18.84	-9.24	<.001
Kcal	2198	868	1757	579	-441	<.001
BMI	30.9	6.90	26.83	6.66	-4.04	<.001

Data is presented as means +/- SD
Samples analysed using independent samples t-test, significant at P<.05

Figure 6 represents the self-reported dietary changes undertaken to manage fibromyalgia by participants in the subgroup. The changes are categorised into whole dietary changes, dietary inclusions and exclusions, with the effect on pain score considered. 74% of subgroup participants self-reported a complete dietary change intended to manage their fibromyalgia symptoms; these included vegetarian diets (35%), including pescatarian and ovo-lacto vegetarians, ketogenic diet (18%), vegan diet (11%) or Hashimoto diet (10%). Carbohydrates were targeted (removed or reduced) by 43% of participants. The exclusion of alcohol and fish were also associated with the highest reductions in mean reported pain, (83.9% and 88.9% reduction respectively) whilst garlic and onion (44% reduction) and dairy (68.4% reduction) represented the lowest impact on pain levels pre- and post-dietary change.



Figure 6. Impact of self-reported dietary changes on pain scores.

*Indicated by whole diet change (green), foods removed (blue), foods added (orange).
Larger font size indicates higher frequency of reported change (font scaled by 15 + 1 per variable).
Darker colours indicate larger changes in pain scores.*

The types of media accessed to support dietary changes, specifically aimed to impact fibromyalgia are shown in **Figure 7**. The majority of responses (n=39, 76.5%) reported obtaining information from social media or websites with very few (n=5, 9.8%) accessing a professional for support.

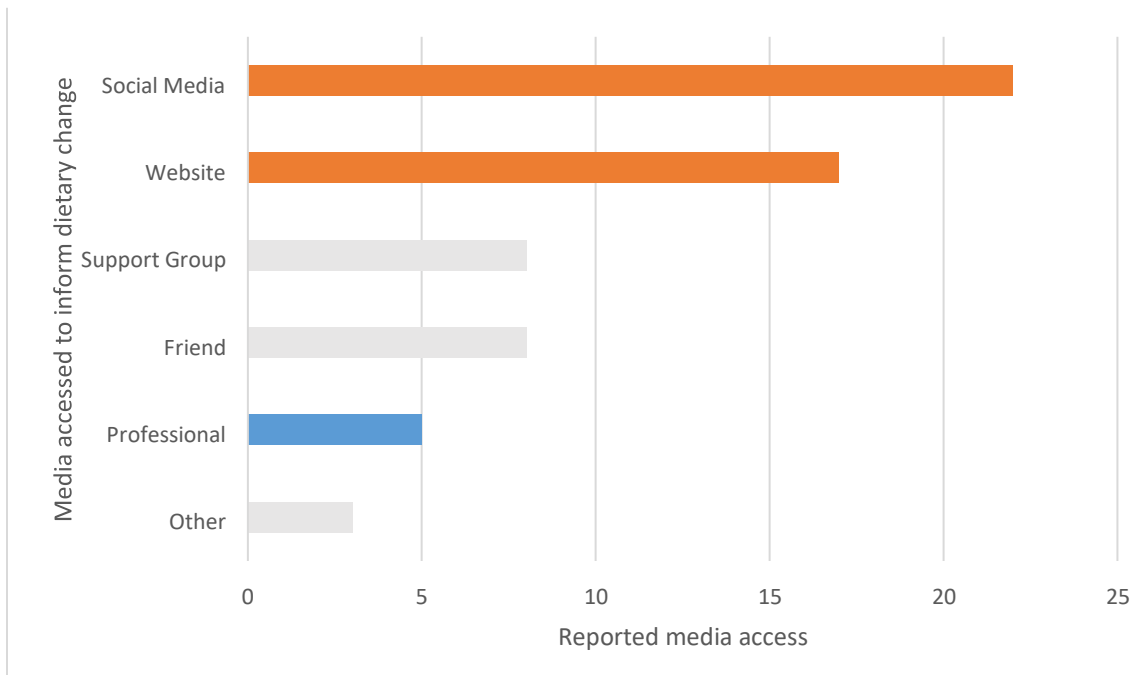


Figure 7. Participants self-reported media accessed to support dietary change. *Data presented as participant numbers (n=51). Data is limited to participants with self-reported dietary modifications.*

9 Discussion

In the present cross-sectional study, in 381 adults, we observed that fibromyalgia sufferers with greater diet quality reported significantly lower pain and symptom scores (FIQR). Participants with lower FIQR scores (<49) scored significantly higher across 7 out of 11 HEI components including the moderation components, refined grains and saturated fat. We also observed higher BMI and overall energy intake in participants reporting greater pain severity, and the lowest symptom severity in those with a healthy weight. Higher energy intakes resulted in greater BMI and FIQR scores. Unique to this study is the employment of a whole diet approach to assessing diet quality through the use of the healthy eating index (HEI, 2015).

In addition to reporting lower intakes of sodium and added sugar and higher intakes of total vegetables and whole grains, fibromyalgia sufferers with low FIQR scores reported significantly higher intakes of total and whole fruit, dairy, protein and fatty acids and significantly lower intakes of refined grains and saturated fat, and hence a higher adherence to healthy eating guidelines. Fruit and vegetable intake is widely recognised to support disease prevention, as well as promoting good mental health (Głąbska, Guzek, Groele & Gutkowska, 2020; Wallace et al., 2020) and higher intakes have been linked with pain reduction (Ferraz, et al., 2020). Some fruits, including berries and pomegranates have analgesic properties due to polyphenolic flavonoids and supplementation has shown positive effects on pain (Basu, Schell & Schofield, 2019; Ferraz, et al., 2020). Additionally, fruits and vegetables support bowel health as source of dietary fibre which may mediate IBS associated with fibromyalgia (El-Salhy, Ystad, Mazzawi, & Gundersen, 2017; Yang et al., 2017). Saturated fat has been linked to cardiovascular disease, increased cholesterol and cognitive impairment (Briggs, Petersen & Kris-Etherton, 2017). Animal studies suggest high intakes of saturated fat may have negative impacts on pain (Tian et al., 2018) stimulating hyperalgesia, although no supporting human studies. No specific research into refined grains has been undertaken in fibromyalgia. Caution should be applied to nutritional studies in fibromyalgia as sample sizes are often small and adherence to dietary intervention is

rarely evaluated, resulting in potential bias (Pagliai et al. 2020). A whole dietary approach, whilst not without challenges may provide a better understanding of dietary impact on the disease.

The HEI allows us to collectively assess dietary adherence between groups to identify distinctions with some acknowledged exclusions, including sodium added post food preparation (Kirkpatrick et al., 2018). It is important to note that mean HEI for this group (49.5 ± 9.89) falls within the range for similar studies. Low HEI scores, such as those seen in the Food4me obesity cohort (49.2 ± 9.9) (Fallaize et al., 2018) have been associated with higher adiposity, total cholesterol, cardiovascular disease and most importantly premature death (George et al., 2014; Li, et al, 2019; Maskarinec et al., 2020) In addition, higher diet quality scores are associated with significant reductions in all-cause mortality, including common comorbidities associated with fibromyalgia. (Petermann-Rocha, Gray, Pell, et al., 2020; Schwingshackl et al., 2018; Sotos-Prieto et al., 2017). As in other fibromyalgia studies, a large number of our participants reported co-morbidities or multimorbidity (73%), which may impact on their nutritional requirements. Studies looking at specific chronic disease include an American population study which aimed to explore the role of diet quality on spinal pain found significantly lower adherence to dietary guidelines in those with spinal pain than without (51.97 ± 0.65 vs 54.31 ± 0.39) (Zick, Murphy & Calocino, 2020). Similarly, a cross sectional study to understand the role of diet quality in rheumatoid arthritis, resulted in a mean score of 58.7 ± 15.9 (Berube et al., 2017), suggesting diet quality plays a role in the mediation of pain not limited to fibromyalgia.

The observations of higher BMI and overall energy intake in participants reporting greater pain severity, and the lowest symptom severity in those with a healthy weight has been reported previously (Bennet et al., 2007; Pagliai 2020). Individuals with chronic pain may choose food for analgesic effect (de Freitas et al., 2012; O'Loughlin, Toby, Bewton-John, 2019). Research suggests food is used as a coping mechanism for pain, with participants reporting relief, although temporary, from energy dense, high fat, high sugar food sources (Amy Janke & Kozak, 2012; Chrisholm et al., 2016;). This

propensity for energy dense foods, may result in a cycle of weight gain, further impacting chronic pain and symptoms (Choi et al., 2014; Janke et al., 2016). Reliance on food for relief may be described as behavioural addiction, and relevant support pathways may be needed for weight management (Bonder, Davis, Kuk & Loxton, 2018; Schulte, Potenza & Gearhardt, 2017; Taylor, Curtis & Davis, 2010). Limited physical activity, due to pain may lead to increased body weight (Geenen et al, 2017, Hitt et al, 2007; Summer, Wren & Keffe, 2011). Restricted diets with increased physical activity, with the aim of weight loss, have shown significant improvements in pain, quality of life, depression and anxiety (Shapiro et al., 2005), however as they study was only 20 weeks long, the longevity of these interventions are not fully explored.

In the present study 38.6% of participants reported Vitamin D intakes below the UK average, with lower intakes significantly associated with higher pain and symptom scores (PHE, 2020). This association was only significant in individuals with less than 5ug dietary intake per day, half the UK recommended dose of 10ug (SACN, 2016), although we cannot exclude vitamin D sourced from sunlight. It is proposed that low vitamin D intake can lead to increased pain levels and is a common feature in arthritis, muscle pain and chronic widespread pain (Helde-Frankling & Bjorkhem-Bergman, 2017; Wu et al., 2018). A 2017 meta-analysis concluded that there is credible evidence that Vitamin D intake can impact fibromyalgia symptoms (Makrani et al, 2017), and suggested that Vitamin D should be considered as a preventative strategy. This study was only undertaken in females.

We also observed a link between symptom scores and low iron intake. There are cross overs between the symptoms of iron deficiency and fibromyalgia, with the most prevalent being fatigue and cognitive dysfunction, often described as 'fibro-fog' (Ortancil, 2010). Whilst some studies found no link between iron intake and symptoms, (Mader et al., 2012) we observed a clear impact, with higher intakes seen in participants with lower FIQR scores. Okan et al. (2019) found a significant correlation between depression and sleep quality in fibromyalgia patients with iron deficiency when compared with controls, and supplementation has in some cases improved pain and

fatigue in patients with fibromyalgia (Dowling et al., 2009). Dietary intakes for calcium, B12, Mg or Na⁺, were not associated with pain and symptom scores in the present analysis, which is a contradiction to previous studies but may be due to differences in study design (Kasim, 2017; Joustra et al., 2017, Andretta, et al 2019). Whilst previous studies highlight links between pain (FIQR), depression and anxiety (Furness, 2018; Zamini, Alizadeh and Zamini, 2019) it is important to note that no significance was seen in this study.

Despite a lack of robust evidence to date for diet impact on fibromyalgia symptoms, it is anecdotally acknowledged by those with fibromyalgia to manage symptoms (Lowry et al., 2020; Silva, 2019). In our study, 26% of participants self-reported making dietary changes to manage their fibromyalgia symptoms, however the period of change was not recorded, which limits the interpretation of this data and the objective element of self-reporting may result in bias. Self-reported changes included reducing carbohydrate intake (43%). It is interesting to note that the FFQ data suggests an association between significantly higher intakes of CHO and total participants with higher FIQR scores (=> 49). Similar links have been found in individuals with knee pain (Strath, et al., 2020), an intervention study where low CHO diets resulted in significantly reduced markers of pain and oxidative stress, however the quality and type of CHO's in this study were not controlled. Whole dietary change, amongst those participants making self-reported dietary changes, focused on plant-based diets. Improvements in pain levels were reported in participants excluding meat and fish, exclusion of the later having the largest reported impact on pain.

Plant based diets have been known to produce reductions in pain, inflammation and weight (Lee et al., 2016; Medawar, Huhn, Villringer & Witte, 2019; Turner Mc-Grievey et al., 2015), however, limited impact on neurological status has been reported, which may be important in fibromyalgia (Watson et al., 2010). However, these studies include low participants numbers and adherence to intervention was not fully controlled. Common between studies is a beneficial impact of weight loss suggesting impacts seen in specific nutrients or diets may be misleading. Dietary regulation is a common behaviour

change strategy used to promote weight reduction (Gudzune et al., 2015), therefore it can be argued that a reduction in total body weight may be a key factor in managing fibromyalgia symptoms.

9.1 Implications for clinical practice

The costs of medical treatment for fibromyalgia are fairly insubstantial in comparison to other diseases (Briggs, Scarborough, & Wolstenholme, 2018) and the burden of disease is mostly felt in social funding (Barry et al., 2018; Lacasse, Bourgault, & Choinière, 2016,) and less so to the NHS. A failure to diagnose has a cost of its own, in repeated GP visits and investigations (Annemans et al., 2008), which might explain the claims by Fitzcharles and Bolous (2003) that fibromyalgia is often over diagnosed. Whilst previous studies have acknowledged the need for further research into the impact of the disease, the overall economic impact is widely unknown. As such, there will continue to be a “one size fits all” approach to treatment and limitations placed on access to secondary referrals. However, with symptoms of Fibromyalgia being reflected in individuals suffering from Long Covid (Greenhalgh, Knight, A’Court, Buxton & Husain, 2020; Ladds, Rushforth, Wieringa, et al., 2020), including fatigue, neurocognitive difficulties, muscle pain and weakness, there may be some cross over in treatments developed that can reduce the symptoms in both conditions.

In this study we also investigate sources of self-prescribed advice. Our results indicate that this was obtained via peers and online forums for dietary change. The current study acknowledges the sources accessed to prompt dietary changes and highlights a lack of reliance on professional support, instead citing online community support groups and peer support. The study agrees with previous research that social media is a key area for obtaining health knowledge and has an influence in determining decisions around diet (Mazanderani, Locock & Powell, 2012; Ziebland, Lavie-Ajayi & Lucius-Hoene, 2015).

Adhering to guidelines for Vitamin D supplementation might be an area to explore to reduce overall disease severity but a clearer public health message, linked with pain

management may be required to encourage uptake. In the most recent NICE draft guidelines (NICE, 2020), the role of vitamin D was not considered in the management of chronic pain in over 16s. As fibromyalgia alone is not a referral criterion for dietetic care in the UK (BDA, 2017), it is not surprising that anecdotal evidence is most highly referenced amongst participants and suggests a flaw in the limited access to nutrition professionals for this disease. The UK Allied Health Professions Public Health Strategic Framework (2019-2024) alongside the NHS long term plan (2019) underlines the role of all AHPs, including dietitians, in the prevention and reduction of health inequalities. Under the population health strand, AHPs are tasked with supporting the self-management of long-term conditions. It could be suggested that to meet these outcomes, individuals with fibromyalgia should have access to nutrition professionals to support symptom management and to promote public health strategies including vitamin D supplementation.

9.2 Strengths and Limitations

A validated FFQ was used to assess habitual diet, having the advantage of being simple and cost-effective to assess “usual” diet over longer periods of time (Resnicow, 2000) and discriminating individuals in relation to their dietary intake. FFQs are considered a strong tool to examine relationships between intake and disease, although limitations of self-reported dietary intakes should be acknowledged (WHO, 2003). An internet-based platform was an effective method for recruiting participants with fibromyalgia, which resulted in a large sample size (Blumenberg, et al., 2019), however this design may limit depth of information, versus interviews, and the number of measures collected (Shim, Oh & Kim, 2014). Males are less likely to participate in survey-based research than women (Curtin et al., 2000; Moore & Tarnai, 2002; Singer et al., 2000) and whilst the focus of this study was not gender specific it is important to note that the majority of fibromyalgia research is undertaken using females (Segura Jiménez, 2016) and where gender has been a focus, male participation has been limited, reducing the validity of results (Aparicio, 2012).

9.3 Conclusion

This study highlights a link between diet quality, BMI and pain levels in fibromyalgia sufferers. Higher HEI scores were associated with significant improvement in pain and symptoms indicated in lower FIQR scores. There is some evidence to suggest specific micronutrients, including Vitamin D and Iron, may play a role in the mediation of pain and symptoms. Self-prescribed diets may be beneficial to individuals with fibromyalgia, including supporting weight management, however this should be confirmed with well-designed trials. The study highlights a lack of guidance on nutrition from health care professionals, resulting in individuals looking for advice from support groups and their peers, that may not always be based on sound science.

10 Future research and recommendations

Future research may benefit from further exploring the impact of diet quality on fibromyalgia symptoms in larger cross-sectional studies and RCTs, with equal gender representation. Exploration of micronutrient supplementation via RCTs may result in clearer guidance for individuals with fibromyalgia. Analysis of urine and blood results can provide more accurate results on nutritional status. Results from this and future studies should be implemented in the creation of specific nutrition guidance for individuals with chronic pain including fibromyalgia.

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12 Appendix

Appendix A

Participant Survey

Respondent data

Welcome to the research study!

We are interested in understanding the association between dietary habits and participant led adaptation to diet for pain management in fibromyalgia sufferers. You will be asked to complete a series of questions in relation to your fibromyalgia symptoms. You will be asked to complete a food frequency questionnaire and information about any dietary changes you have made in relation to your fibromyalgia.

The study should take you around 60 minutes to complete. Your participation in this research is voluntary. You have the right to withdraw at any point during the study, for any reason, and without any prejudice.

This form will allow you to register for the survey and once registered you will be provided with a unique identification number, password and survey link.

By clicking the button below, you acknowledge that your participation in the study is voluntary, you are 18 years of age, and that you are aware that you may choose to terminate your participation in the study at any time and for any reason. You have been informed of storage methods for data collected in this study and any risks associated with participation. Please be assured that your responses will be kept completely confidential. UH protocol number **LMS/PGR/UH/03765**. Please note this application has been approved by the Health, Science, Engineering & Technology ECDA.

Please note that this survey will be best displayed on a laptop or desktop computer. Some features may be less compatible for use on a mobile device.

If you would like to contact the Principal Investigator in the study to discuss

this research, please e-mail Simone Bothwell on S.Bothwell@herts.ac.uk.
Principal supervisor Katerina Vafeiadou - k.vafeiadou@herts.ac.uk

Do you consent to take part in this survey?

- Yes
- No

Gender

[Dropdown menu]

Date of Birth

[Date input field]

In which country do you currently reside?

[Country dropdown menu]

Medical information

Do you have a diagnosis from a medical professional?

[Radio buttons]

Are you prescribed medication for fibromyalgia?

- Yes
- No

Medications specific to fibromyalgia

	Medication	Strength (each tablet or capsule)	Amount (Number of tablets, capsules or tsp in 1 day)
1			
2			
3			
4			
5			
6			

Do you suffer from any other medical conditions related or unrelated to fibromyalgia?

Do these medical conditions require you to take medication?

- Yes

- No

Medications specific to other conditions.

	Condition	Medication	Strength (each tablet or capsule)	Amount (Number of tablets, capsules or tsp in 1 day)
1				
2				
3				
4				
5				
6				

Do you take other over the counter medications?

- Yes
- No

Over the counter medication information.

	Medication	Reason for use	Amount (Number of tablets, capsules or tsp in 1 day)	Frequency of use
1				
2				

3
4
5
6

BMI

Height: please record this measure in metres.
Height can be calculated by removing your shoes, standing with your back to the wall and looking directly forward. The back of your feet, calves, bottom, upper back and the back of your head should all be in contact with the wall. Using a flat item rested on the crown of the head make a light mark on the wall. Measure from the ground to this mark using a tape measure.

Weight: please record this in kg.
Use a digital scale. Avoid using bathroom scales that are spring-loaded. Place the scale on firm flooring (such as tile or wood) rather than carpet. Remove shoes and heavy clothing. Stand with both feet in the centre of the scale. Please leave this section blank if you do not have access to digital scales.

FIQR

For each of the following 9 questions, check the box that best indicates how much your Fibromyalgia made it difficult to perform each of the following

activities during the past 7 days. If you did not perform a particular activity in the last 7 days, rate the difficulty for the last time you performed the activity. If you can't perform an activity, check the last box.

	No difficulty										Very difficult											
	0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10
Brush or comb your hair	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Walk continuously for 20 minutes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prepare a homemade meal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vacuum, scrub, or sweep floors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lift and carry a bag full of groceries	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Climb one flight of stairs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Change bedsheets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sit in a chair for 45 minutes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shop for groceries	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For each of the following 2 questions, check the box that best describes the overall impact of your Fibromyalgia over the last 7 days.

Never										Always											
0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10

Fibromyalgia prevented me from accomplishing goals for the week

I was completely overwhelmed by my fibromyalgia symptoms

For each of the following 10 questions, select the box that best indicates your intensity level of these common Fibromyalgia symptoms over the past 7 days.

		0	1	2	3	4	5
Please rate the level of pain	No Pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Please rate your level of energy	Lots of energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Please rate your level of stiffness	No stiffness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Please rate the quality of your sleep	Awoke rested	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Please rate your level of depression	No depression	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Please rate your level of memory problems	Good memory	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Please rate your level of anxiety	Not anxious	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Please rate your level of tenderness to touch	No tenderness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Please rate your level of balance problems	No imbalance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Please rate your level of sensitivity to loud	No	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

noises, bright lights, odors, and cold. sensitivity

PHQ-9 + GAD-7

Over the last 2 weeks, how often have you been bothered by any of the following problems?

	Not at all	Several days	More than half the days	Nearly every day
Little interest or pleasure in doing things?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling down, depressed, or hopeless	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trouble falling or staying asleep, or sleeping much	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling tired or having little energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Poor appetite or overeating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling bad about yourself — or that you are a failure or have let yourself or your family down	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trouble concentrating on things, such as reading the newspaper or watching television	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thoughts that you would be better off dead or of hurting yourself in some way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Over the last 2 weeks, how often have you been bothered by the following problems?

	Not at all	Several days	More than half the days	Nearly every day
Feeling nervous, anxious or on edge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not being able to stop or control worrying	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Worrying too much about different things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trouble relaxing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being so restless that it is hard to sit still	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Becoming easily annoyed or irritable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling afraid as if something awful might happen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

FETA

YOUR DIET LAST YEAR

For each food there is an amount shown, either a "medium serving" or a common household unit such as a slice or teaspoon. Please put choose the options which, on average, you have eaten the specified amount of each food during the past year.

EXAMPLES

BREAD OR SAVOURY BISCUITS (one slice or biscuit)	Never or less than once a month	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4-5 per day	6+ per day
White bread and rolls				<input checked="" type="radio"/>					

MEAT AND FISH (medium serving)

	Never or less than once/month	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4-5 per day	6+ da
Beef: roast, steak mince, stew or casserole	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beefburgers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pork: roast, chops, stew or slices	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lamb: roast, chops or stew	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chicken or other poultry eg. turkey	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bacon	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ham	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Corned beef, Spam, luncheon meats	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sausages	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Savoury pies, eg. meat pie, pork pie, pasties, steak & kidney pie, sausage rolls	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Liver, liver									

paté, liver sausage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fried fish in batter, as in fish and chips	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fish fingers, fishcakes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other white fish, fresh or frozen, eg. cod, haddock, plaice, sole, halibut	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Oily fish, fresh or canned, eg. mackerel, kippers, tuna, salmon, sardines, herring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shellfish, eg. crab, prawns, mussels	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fish roe, taramasalata	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

BREAD AND SAVOURY BISCUITS (one slice or biscuit)

	Never or less than once/month	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4-5 per day	6+ day
White bread and rolls	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

CEREALS (one bowl)

	Never or less than once/month	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4-5 per day	6+ day
Porridge, Ready brek	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Breakfast cereal such as cornflakes, muesli etc.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

POTATOES, RICE AND PASTA (medium serving)

	Never or less than once/month	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4-5 per day	6+ day
Boiled, mashed, instant or	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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tarts, crumbles, home baked	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fruit pies, tarts, crumbles, ready made	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sponge puddings, home baked	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sponge puddings, ready made	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Milk puddings, eg, rice, custard, trifle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ice cream, choc ices	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chocolates, single or squares	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chocolate snack bars eg, Mars, Crunchie	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sweets, toffees, mints	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sugar added to tea, coffee, cereal (teaspoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Crisps or other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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packet snacks, eg, Wotsits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Peanuts or other nuts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

SOUPS, SAUCES, AND SPREADS

	Never or less than once/month	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4-5 per day	6+ per day
Vegetable soups (bowl)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Meat soups (bowl)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sauces, eg, white sauce, cheese sauce, gravy (tablespoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tomato ketchup (tablespoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pickles, chutney (tablespoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Marmite, Bovril (teaspoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jam, marmalade, honey (teaspoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Peanut	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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butter (teaspoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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DRINKS

	Never or less than once/month	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4-5 per day	6+ per day
Tea (cup)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coltee, instant or ground (cup)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coffee, decaffeinated (cup)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coffee whitener, eg, Coffee-mate (teaspoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cocoa, hot chocolate (cup)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hotlicks, Ovaltine (cup)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wine (glass)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beer, lager or cider (half pint)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Port, sherry, vermouth, liqueurs (glass)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Spirits, eg, gin, brandy, whisky,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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vodka (single)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Low calorie or diet fizzy soft drinks (glass)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fizzy soft drinks, eg, Coca cola, lemonade (glass)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pure fruit juice (100%) eg, orange, apple juice (glass)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fruit squash or cordial (glass)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

FRUIT
For seasonal fruits marked *, please estimate your average use when the fruit is in season

	Never or less than once/month	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4-5 per day	6+ per day
Apples (1 fruit)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pears (1 fruit)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Oranges, satsumas, mandarins (1 fruit)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Grapefruit (half)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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jacket potatoes									
Chips	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Roast potatoes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Potato salad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
White rice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Brown rice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
White or green pasta, eg. spaghetti, macaroni, noodles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wholemeal pasta	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lasagne, moussaka	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pizza	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

DAIRY PRODUCTS AND FATS

	Never or less than once/month	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4-5 per day	6+ da
Single or sour cream (tablespoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Double or clotted cream (tablespoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Low fat									

yogurt, fromage fraits (125g carton)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Full fat or Greek yogurt (125g carton)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dairy desserts (125g carton)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cheese, eg. Cheddar, Brie, Edam (medium serving)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cottage cheese, low fat soft cheese (medium serving)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eggs as boiled, fried, scrambled, etc. (one)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Quiche (medium serving)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Low calorie, low fat salad cream (tablespoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Salad cream, mayonnaise (tablespoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
French									

dressing (tablespoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other salad dressing (tablespoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The following on bread or vegetables

	Never or less than once/month	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4-5 per day	6+ day
Butter (teaspoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Block or hard margarine, eg. Stork, Krona (teaspoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Polyunsaturated margarine, eg. Flora, sunflower, soya spreads (teaspoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Soft margarines, including olive oil based and dairy spreads, eg. Blue Band, Olivio/ Bertoli, Clover (teaspoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Low fat spreads (less than 80% fat), eg. Outline, Gold (teaspoon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Very low fat spread (less than 30% fat)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

teaspoon)									
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SWEETS AND SNACKS (medium serving)

	Never or less than once/month	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4-5 per day	6+ day
Sweet biscuits, chocolate, eg. digestive (one)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sweet biscuits plain eg. Nice, ginger (one)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cakes eg. fruit, sponge, home baked	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cakes eg. fruit, sponge, ready made	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Buns, pastries eg. scones, flapjacks, home baked	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Buns, pastries eg. croissants, doughnuts, ready made	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fruit pies,									

Bananas (1 fruit)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Grapes (medium serving)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Melon (1 slice)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* Peaches, plums, apricots (1 fruit)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*									
Strawberries, raspberries, kiwi fruit (medium serving)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tinned fruit (medium serving)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dried fruit, eg. raisins, prunes (medium serving)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

VEGETABLES
Fresh, frozen or tinned (medium serving)

	Never or less than once/month	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4-5 per day	6+ da
Carrots	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Spinach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Broccoli, spring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

greens, kale	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Brussels sprouts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cabbage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Peas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Green beans, broad beans, runner beans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Marrow, courgettes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cauliflower	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Parsnips, turnips, swedes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Leeks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Onions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Garlic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mushrooms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sweet peppers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beansprouts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Green salad, lettuce, cucumber, celery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Watercress	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tomatoes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sweetcorn	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Beetroot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coleslaw	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Avocado	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Baked beans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dried lentils, beans, peas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tofu, soya meat, TVP, Vegeburger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

FETA 2

YOUR DIET LAST YEAR, continued
Are there any OTHER foods which you ate more than once a week?

[:]

If YES, please list below

Food	Number of times eaten/week	Usual Serving Size
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food	Number of times eaten/week	Usual Serving Size
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food	Number of times eaten/week	Usual Serving Size
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food	Number of times eaten/week	Usual Serving Size
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Food	Number of times eaten/week	Usual Serving Size
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food	Number of times eaten/week	Usual Serving Size
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What type of milk did you most often use?

[:]

Please describe which milk you use most often

How much milk did you drink each day, including milk with tea, coffee, cereals etc?

[:]

Did you usually eat breakfast cereal (excluding porridge and Ready Brek mentioned earlier)?

[:]

If YES, which brand and type of breakfast cereal, including muesli, did you usually eat?

Brand Type

Brand Type

FETA Fats and Frying

What kind of fat did you most often use for frying, roasting, grilling etc?

If you used vegetable oil, please give type eg. corn, sunflower

What kind of fat did you most often use for baking cakes etc?

If you used margarine, please give name or type eg. Flora, Stork

How often did you eat food that was fried at home?

How often did you eat food away from home?

What did you do with the visible fat on your meat?

How often did you eat grilled or roast meat? (times a week)

How well cooked did you usually have grilled or roast meat?

Salt

How often did you add salt to food while cooking?

How often did you add salt to any food at the table?

Did you regularly use a salt substitute (egLoSalt)?

If yes, which brand?

Average intakes

During the course of last year, on average, how many times a week did you eat the following foods?

	Times/week
Vegetables (not including potatoes) - medium serving	<input type="text"/>
Salads - medium serving	<input type="text"/>
Fruit and fruit products (not including fruit juice) - medium serving or 1 fruit	<input type="text"/>
Fish and fish products - medium serving	<input type="text"/>
Meat, meat products and meat dishes (including bacon, ham and chicken) - medium serving	<input type="text"/>

Vitamins and Minerals

Have you taken any vitamins, minerals, fish oils, fibre or other food supplements

during the past year?

If YES or SOMETIMES, please complete the tables below.

If you have taken more than 8 types of supplement please put the most frequently consumed brands first.

Example: If you take one tablet of vitamin C two times a day, please write '2' in the amount- column and cross the 'once a day' box. Most supplements mention a strength value (in our example 500mg), please write this information in the table.

1	2	3	4	5	6	7	8	Amount (Number of tablets, capsules or tsp in 1 day)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Average frequency for the past year

INDICATE ONE box per line to show how often on average you took the amount consumed as mentioned in 'amount' column

	Never or less than once a month	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day
1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Dietary impact on pain

Have you made any dietary changes to impact your pain levels?

- Yes
- No

Have you removed or added any items to your diet?

	Food type	Added/Removed
A		
B		
C		

D

E

F

What pain improvements were seen from dietary modifications?

	Very Much Improved	Much Improved	Minimally Improved	No Change	Minimally Worse	Much Worse	Very Much Worse
A	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
B	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
C	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
D	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
E	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
F	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Before the dietary changes for each item how would you describe your overall levels of pain

	0	1	2	3	4	5	6	7	8	9	10
A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

After changing your diet for each of the above items how would describe your overall levels of pain

	0	1	2	3	4	5	6	7	8	9	10
A	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
B	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
C	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
D	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
E	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
F	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How long after making changes did you experience improvements in pain or symptoms (if applicable)?

	Days	Weeks	Months
A			
B			
C			
D			
E			
F			

Impact of social media

What sources did you use to make these dietary choices?

- Social Media
- Medical Professional
- Dietitian
- Friend
- Support group
- Magazine
- Website
- Other

How difficult or easy were these changes to maintain?

Any other relevant information.
Please use this area to provide any other relevant information you feel you wish to share.

Appendix B – Extract from *The Fibromyalgia Magazine*, with facebook group responses to dietary impact on fibromyalgia.

Which foods/drinks trigger your fibromyalgia?

By Shel Bowden

We are often told that certain foods or drinks can make our Fibromyalgia worse so this month we asked our Facebook group members "Which foods/drinks trigger your fibromyalgia?" members were allowed to add their own options:

Aspartame (sweeteners)	64 votes
Refined Carbohydrates (white flour, white bread, white rice, pastries, biscuits etc)	56 votes
Alcohol	47 votes
Processed Foods	38 votes
Sugar	36 votes
Gluten	29 votes
Caffeine	23 votes
I don't know (member)	23 votes
Dairy	22 votes
Fizzy drinks	21 votes
Chocolate	18 votes
Red Meat	12 votes
Nightshade Vegetables (tomatoes, white potatoes, green peppers, goji berries)	9 votes
Eggs	6 votes
a variant of the above options (member)	5 votes
None (member)	4 votes
Energy drinks (Red Bull etc) (member)	3 votes
Bananas	1 votes

Most fibromyalgia diets recommend cutting out processed foods and sugars and increasing the number of vegetables and whole foods, doctors now seem to be recommending the FODMAP diet. But as each of us is very different what you need to do is work out which foods trigger you, a good way to do this is to keep a food and symptom diary which will help you see what foods you have eaten just before a flare in symptoms, this is best done over a long time as just because you had a take away one time and a flare in the next few days doesn't mean that, that takeaway was the trigger, but if you had the takeaway 3 or 4 times and had a flare after every time then you can definitely say that it is a trigger for you. It can be useful to add an activity part into your diary as sometimes an activity may be the trigger instead of food or drink.

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