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Food and Health 2023;5(4):17. https://doi.org/10.53388/FH2023017

Food intolerance and sensitivity are associated with features of fibromyalgia in a self-selected community population

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Author contributions
Conceptualization, CK; methodology, ET, HB, LR; software, EP; validation, ET, HB, LR; formal analysis, CK, ET, HB, LR.; investigation, ET, HB, LR, EP.; resources, CK, EP.; data curation, ET, HB, LR; Writing original draft preparation, CK.; writing, review and editing ET, HB, LR and EP; supervision/project administration, CK. All authors read and agreed to the published version of the manuscript.

Competing interests
The authors declare no conflicts of interest.

Acknowledgments
The authors received no financial support for the research, authorship, and/or publication of this article.

Ethical Statement
The study was conducted in accordance with the Declaration of Helsinki and approved by Newcastle University's FMS Research Ethics Committee (15052/2021) in September 2021. Informed consent was obtained from all subjects involved in the study, while data supporting results can be obtained on written request from the Department of Psychology at Newcastle University.

Peer review information
Food and Health thanks Jing Chen and other anonymous reviewers for their contribution to the peer review of this paper.

Abbreviations
ADHD, attention deficit hyperactivity disorder; ARFID, avoidant restrictive food intake disorders; ASD, Autism Spectrum Disorders; BS, Beighton Score; FSQ, Fibromyalgia Survey Questionnaire; GFD, gluten free diet; MSK, musculoskeletal; RPS, Research Participation Scheme; SSS, Symptom Severity scale; WPI, Widespread Pain Index.

Citation
Thomson E, Beer H, Ryan L, Philcox E, Kelly C. Food intolerance and sensitivity are associated with features of fibromyalgia in a self-selected community population. *Food Health.* 2023;5(4):17. doi:10.53388/FH2023017.

Executive editor: Nuo-Xi Pi.
Received: 27 July 2023; **Accepted:** 10 October 2023; **Available online:** 24 October 2023.

Abstract
Introduction: People are now presenting with chronic musculoskeletal pain at a younger age, and many of them fulfil criteria for fibromyalgia. We have recently shown a strong association between fibromyalgia symptoms and autistic traits in a self-selected community population, with the relationship mediated in part by the presence of hypermobility. Many respondents also described food sensitivities and intolerances. This study explores the relationships between food issues and fibromyalgia symptoms in this population. **Methods:** We adopted a nonexperimental, correlational design and collected data from a volunteer sample of 442 adults (aged 18–60) who completed online self-report questionnaires assessing each of fibromyalgia symptoms (ACR criteria), autistic traits (RAADS score) and hypermobility (Beighton's test). Subjects were also asked to record any food sensitivities, allergies, or intolerances, along with their consequences. Correlation analyses and linear regressions were used to test the relationships between these features and each of fibromyalgia, autistic traits and hypermobility. We analysed the data with parametric and non-parametric techniques to assess the significance and power of relationships, and the potential mediating effect of food-related symptoms in the correlation between fibromyalgia features and autistic traits. **Results:** Our self-selected community population had a mean age of 24 years and was 77% female. The self-reported prevalence of fibromyalgia, autistic traits and hypermobility was 40%, 65% and 44% respectively. Hypermobile individuals showed a high prevalence of autistic traits, reaching 79% among females and 88% among males. Half of all subjects reported food sensitivity and 31% reported food intolerance. The incidence of food-related symptoms was higher among subjects who met criteria for fibromyalgia than those who reported autistic traits or hypermobility. Food sensitivity and food intolerance were both more significantly associated with fibromyalgia ($r = 0.24$, $P > 0.001$ and $r = 0.38$, $P > 0.001$) than with autistic traits ($r = 0.172$, $P > 0.01$ and $r = 0.148$, $P > 0.01$). **Discussion:** This community study provides evidence for an association between features of fibromyalgia and reported food intolerance and sensitivity. Although self-selected, the findings in our predominantly young population suggest that gluten and lactose consumption may be associated with higher levels of musculoskeletal pain. The study population commonly reported that avoidance of gluten and/or lactose containing foods reduced symptoms. Dietary adjustment may merit further investigation as a therapeutic modality for some patients with fibromyalgia.
Keywords: fibromyalgia; food intolerance; food sensitivity; autism; hypermobility

Introduction

Fibromyalgia is defined by chronic widespread musculoskeletal (MSK) pain lasting over 3 months [1]. The prevalence of fibromyalgia is close to 5% in the UK population [2] and is highest among young and middle-aged women [3]. Fatigue and cognitive dysfunction (brain-fog) are core components of the symptom complex [1, 4]. While a recent review of fibromyalgia highlights the dimensional rather than the dichotomous nature of the condition [5], the association between allergy and both psychological features [6] and somatisation [7] were highlighted late last century. Many sufferers do report a variety of psychological complaints [8], and strong associations with migraine [9] and gastrointestinal upset are well-described. Irritable bowel syndrome is co-morbid in up to 50% of fibromyalgia sufferers [10].

Speculation about a link between fibromyalgia and gluten sensitivity arose many years ago, and reports of remission of musculoskeletal pain with the adoption of a gluten free diet [11] led to a formal comparison of this approach with a low-calorie diet [12]. Other foods were also recorded as triggering or worsening symptoms of fibromyalgia [13], so a diet low in fermentable sugars was developed (FODMAP) with subsequent evidence that it also improved symptoms [14]. A subsequent systematic review showed that the modest benefits attained in these studies were largely confined to those with some objective evidence of gluten sensitivity in the form of lymphoid enteritis on duodenal biopsy, so recommendations for a widespread adoption of a gluten-free diet were not made [15].

The prevalence of gastrointestinal issues among young neurodivergent people is also high [16], with food sensitivity and intolerance both well described [17]. Again, gluten sensitivity has been reportedly associated with triggering of autistic symptoms, while a gluten free diet (GFD) has been described as improving these symptoms in selected cases [18]. However, there is limited evidence for the role of exclusion diets in the treatment of autism [19], and a systematic review concluded there was insufficient evidence to recommend widespread adoption of this approach [20]. Indeed, there is evidence that highly selective eating can contribute towards both physical and psychological damage [21], as the prevalence of eating disorders such as binge eating, and avoidant restrictive food intake disorders (ARFID) are elevated in autistic females and may contribute significantly to the increased morbidity and mortality associated with these conditions [22].

Several studies have confirmed that a significant percentage of patients with fibromyalgia also have a neurodivergent condition. A South African study showed that fibromyalgia was comorbid with attention deficit hyperactivity disorder (ADHD) in almost half of cases [23] while a study from Argentina reported ADHD in 73% of patients with fibromyalgia, along with a high prevalence of narcissism [24]. Similar associations were reported in Italy [25] and Turkey [26, 27], with the latter studies also suggesting that ADHD was associated with more severe symptoms of fibromyalgia. Dopamine deficiency has been suggested as a common mechanism for both conditions and a trial of dopamine agonist therapy reportedly reduced symptoms of each condition significantly [28].

Studies also confirm a higher prevalence of fibromyalgia and hypermobility among autistic females than in autistic males [29, 30], with one estimate suggesting over three quarters of female autistic females develop MSK pain [31]. A risk ratio of 4.5 for hypermobility was reported in neurodivergent females [32], and it was proposed that hypermobility might mediate the relationship between fibromyalgia and neurodivergence [33]. In support of this, the risk ratios for ASD and ADHD are 7.4 and 6.0 respectively among hypermobile people [33]. Gastrointestinal disorders are also highly prevalent in hypermobility [34] and the combination of hypermobility with autism further increases the prevalence [35].

A recent study of the association between fibromyalgia and autistic traits in a self-selected community-based population dominated by young females suggested that the relationship was partly mediated by hypermobility [36]. Subjects in this study also reported a high prevalence of food sensitivity and intolerance to gluten and lactose. We therefore conducted an analysis of the relationship between these features and the extent of both fibromyalgia symptoms and autistic traits in the same population to explore whether food-related issues might further mediate this relationship. If this proves to be the case, it may both explain the observation and offer the prospect of more specific assessment of the therapeutic role of selective diet in fibromyalgia management.

Methods

Participants

We recruited potential participants both online and via the School of Psychology's Research Participation Scheme (RPS) at Newcastle University. Inclusion criteria included (a) being aged between 18–60 and (b) being a fluent English speaker. Participants were excluded if they did not complete all aspects of the questionnaires. Those who completed the study were invited to enter a lottery draw as an incentive. Ten randomly selected participants were each given £10. Additionally, those recruited via the RPS were granted 1 research credit upon study completion. All participants gave informed consent and were provided with a unique code. They were permitted to withdraw from the research at any stage. Ethical approval was obtained via Newcastle University's FMS Research Ethics Committee (15052/2021).

Procedure

All participants completed an online survey hosted by Qualtrics Survey Software. This survey was advertised to participants via online and social media platforms, including Facebook, Instagram, Twitter, Reddit, Survey Circle and LinkedIn. Posters were displayed around the university campus and we contacted university department facilitators around the UK to share the study nationally. For undergraduate psychology students at Newcastle University, the survey was accessible via the Sona System that is part of the RPS.

Participants were directed to a welcome video explaining the purpose and procedure of the study. Participants were asked to read the digital consent form, reassured that they could withdraw at any stage and that all data would be anonymised. Participants completed a comprehensive demographic questionnaire detailing age, sex, gender, ethnicity, religion, and employment status. Then they were asked to complete self-assessment questionnaires on symptoms of fibromyalgia [37] and autistic traits [38]. In addition, all participants were asked to complete a questionnaire on food sensitivity and food intolerance, detailing any foods that they avoided and the effects that food had on them and their symptoms. Further methodological details are provided in the methods section of our previous paper describing the relationship between fibromyalgia and autistic traits [36].

Design

This study was of a non-experimental, correlational structure. We defined the predictor variable as autistic traits, the outcome variable as fibromyalgia symptoms (pain/dysautonomia), and the mediator variable as food intolerance. The hypothesis was that food-related issues and hypermobility would both partially mediate the relationship between fibromyalgia scores and autistic traits.

Materials/Measures

Fibromyalgia: The Fibromyalgia Survey Questionnaire (FSQ) as adapted by the American College of Rheumatology [37] comprises of two scales: the Widespread Pain Index (WPI) and the Symptom Severity scale (SSS). The WPI quantifies the extent of recent pain on a scale of 0–19. The SSS is composed of two parts. Part 2a assesses fatigue, waking unrefreshed and cognitive symptoms. Part 2b records severity of somatic symptoms, which may reflect autonomic dysfunction. When 2a and 2b are combined, a total score of between 0-12 is obtained.

A diagnosis of fibromyalgia must fulfil either one of two criteria: WPI $\geq$ 7 and SSS $\geq$ 5, or WPI = 3–6 and SSS $\geq$ 9. The total FSQ score

(WPI + SSS) ranges between 0–31, and a score of ≥ 12 meeting criteria for the diagnosis of fibromyalgia. Symptoms should be present for at least 3 months. The FSQ has been widely validated with reasonable sensitivity (64–96%), specificity (60–100%) and validity (Cronbach's α = 0.60–0.87) [38].

Autistic traits: The Ritvo Autism Asperger Diagnostic Scale-Revised (RAADS-R) [39] was modified from the RAADS. This was developed as a clinical tool for adjunctive diagnosis of autism. It is an 80-item scale screening for autistic traits in adults based on the revised DSM-IV scale (APA, 2000). Items are composed of four sub-scales which are lifespan focused: social relatedness, circumscribed interest, language and sensory-motor symptoms. Participants score the extent to which they relate to every statement on a 4-point Likert scale. Cronbach alpha coefficients for the subscales in the ranged from .79 to .92, confirming high internal consistency. A score over 65 is consistent with a diagnosis of autism but is not diagnostic of this condition.

Hypermobility: The Beighton Score (BS) is composed of a set of manoeuvres and is a standard mechanism for assessing hypermobility [40]. The items collate the ability to touch the forearm with the ipsilateral thumb, hyperextension at each fifth metacarpal-phalangeal joints, hyperextension at both elbow and knee joints, along with hyperflexion of the lumbosacral spine. The maximum score is 9 and a score of at least 5 suggests hypermobility in adults aged 18-49, by the 2017 diagnostic criteria for hypermobility [41]. Self-rating by questionnaire has been shown to be reliable [42].

Food related symptoms: The food preference questionnaire was a self-reported 16-item designed by the research team to assess individuals' food preferences, eating patterns, intolerances, and allergies. It consisted of both open and closed questions, which were measured on a 2-point or 3-point Likert scale (1 = No, 2 = Yes; 1 = No, 2 = Maybe, 3 = Yes). The specificity of the questions meant that not all questions could be applied to all participants so skip logic was utilised for user ease. The questions used were as follows: Are there any foods you avoid? (sensitivity); are there any foods which cause you severe symptoms that can require medical intervention? (allergy); are there any foods that cause unpleasantness that doesn't usually require medical attention? (intolerance). Although the questionnaire had been developed specifically for the study and had not been previously formally validated, we conducted a pilot study to assess its performance and modified the format accordingly. This is now presented as (Supplementary Material 1).

Data Analysis

To prepare the data for hypothesis testing, preliminary analyses were conducted on the raw data prior to the main analysis using the software package SPSS v27. Data from 326 participants were removed due to incomplete responses. In the remaining 442 participants with full data sets, the WPI items were scored as dichotomous (yes/no) variables, omitting analysis of internal consistency. To visually assess normality, scatterplots, histograms, outliers, skewness, and kurtosis were examined for each scale using unstandardised residuals. The SSS and RAADS met the normality assumptions, but data for the WPI and FSQ appeared skewed. Thus, a log transformation and square root transformation were applied to the skewed scales to assess the best normality fit. A log-natural transformation was confirmed for the WPI, and a square root transformation was confirmed for the FSQ. Therefore, the transformed data for the WPI and FSQ and the raw data for the SSS and RAADS was used for the main analysis.

The percentage of participants who fulfilled criteria for the diagnosis of each of food intolerance, food sensitivity, fibromyalgia and ASD was calculated for the overall group. Directional Pearson correlations were conducted to assess the strength of the relationships between both scales and food sensitivity, allergy and intolerance [43]. Data from 3 items of the food intolerance questionnaire (Q103, Q108 and Q109) were analysed. These were also found to be abnormally distributed (informed by skewness and kurtosis values). Therefore, non-parametric tests were used as follows: Spearman's correlation, Mann-Whitney U and Kruskal-Wallis. All data analyses were performed using IBM SPSS (Version 27).

Results

Demographics

There were 442 participants who provided a complete dataset suitable for analysis and inclusion within the study. Their median age was 24 (range 18-60) years. Of these, 338 identified their gender as female (76.5%), 70 as male (15.8%), 22 as non-binary (5.0%), 6 as trans-male (1.4%), 2 as trans-female (0.5%) and 4 as 'prefer not to say' (0.8%). These data are shown in more detail in our previous paper [36]. All subjects completed the online survey and the majority (72%) of these were recruited from social media platforms with the remaining 28% responding to the poster campaign. No differences were found between them in terms of the results we collected and analysed.

Thresholds and mean scores

Among the 442 participants, 178 (40.3%) fulfilled criteria for the diagnosis of fibromyalgia and 281 (63.6%) exhibited sufficient autistic traits to meet the RAADS-R threshold for suspected autism. A further 191 (43.9%) subjects met the Beighton criteria for hypermobility. The mean (SD) scores achieved by the participants on each of the major rating scales were fibromyalgia 11.45 (6.73), RAADS-R 83.79 (33.92) and Beighton's test 3.85 (2.76). There were no significant differences in mean scores between those identifying as female vs male. Furthermore, the results of the correlations as described below were not influenced by sex.

Correlation between fibromyalgia score and autistic traits

Among 178 participants scoring 12 or more on the combined fibromyalgia scales, hypermobile individuals showed a high prevalence of autistic traits, reaching 79% among females and 88% among males. The Pearson correlation coefficient between the RAADS-R and the fibromyalgia scores overall was not significant at 0.067 ($P = 0.01$). However, the correlation between RAADS-R and SSS was weakly positive 0.220 ($P = 0.001$), while the correlation between RAADS-R and WPI was not significant at -0.014. Hence the symptom severity score accounted for all the correlation between the criteria for fibromyalgia and the presence of autistic traits.

Frequency of food related symptoms

Of the 442 participants, 225 (50.9 %) reported sensitivity to one or more foodstuffs, 79 (17.9%) reported an allergy to one or more foodstuffs and 138 (31.2%) reported intolerance to one or more foodstuffs. The foods most frequently reported as causing symptoms were those containing gluten (32%), lactose (29%) or alcohol (17%). Reported symptoms were more likely to relate to gastrointestinal function such as abdominal discomfort, nausea and diarrhoea (52%) than musculoskeletal function with pain or tenderness (16%), or mental health issues such as anxiety or depression (11%).

Correlations and analysis of variance between food symptoms and dependent variables

There were significant differences in reports of food sensitivities between those who met criteria for fibromyalgia and those who did not ($U = 17643.00$, $z = -5.04$, $r = 0.240$ $P < 0.001$). There were also significant differences in food allergy between the two groups ($U = 10286.00$, $z = -3.83$, $r = 0.181$, $P < 0.001$) and in reports of food intolerance between those with and without fibromyalgia ($U = 15526.00$, $z = -6.80$, $r = 0.380$, $P < 0.001$). Data presented in Table 1 indicates that correlations between all three categories of food-related symptoms were stronger for subjects meeting criteria for fibromyalgia than with those with either enhanced autistic traits or hypermobility. Both SSS and WPI show moderate positive correlation with each of food intolerance and food allergy.

There was also a significant difference in food sensitivities between those who scored over 65 on the RAADS-R scale when compared to those who did not ($U = 21157.00$, $z = -2.90$, $r = 0.148$, $P = 0.004$). Likewise, there was significant difference in reports of both food allergy ($U = 20540.50$, $z = -2.44$, $r = 0.12$, $P = 0.015$), and food

intolerance (U = 19655.50, z = -2.58, r = 0.12, *P* = 0.010) between the groups. By contrast, there was no significant difference in reports of food sensitivities between those who had a positive Beighton test and those who did not (U = 23263.00, z = -.854, r = -0.04, *P* = 0.39). However, there were significant differences in the reports of food allergy (U = 11306.50, z = -2.84, r = 0.14, *P* = 0.004) and food intolerance (U =20323.00, z = -3.08, r = 0.15 *P* = 0.002,) between those who had a positive Beighton test and those that didn't.

Regressions and variance

RAADS-R scores explained 20.4% of the variance in SSS (R2 = 0.204, F (114.421) = 447), but RAADS-R scores accounted for just 5.9% of the variance in WPI scores (B = 1.435, t = 5.279). This again emphasises that symptoms suggesting dysautonomia account for the correlation with autistic traits. A significant partial mediation between fibromyalgia and autistic traits was also found through hypermobility (t = 3.606, *P* = 0.0001). Figure 1 shows the mediation model with the proposed role of food sensitivities, intolerances, and allergies in mediating the relationship between fibromyalgia, autistic traits and hypermobility.

Discussion

This study demonstrated that within our self-selected sample, mainly comprising young females, those who reported features of fibromyalgia were also more likely to describe food sensitivity and / or intolerance. Food-related symptoms manifested as gastrointestinal distress more often than as musculoskeletal or psychiatric features and was most often associated with either gluten or lactose consumption. Those with significant autistic traits and / or hypermobility were also statistically more likely to report food-related symptoms. Food sensitivities, along with hypermobility, may partially mediate the relationship between fibromyalgia and autistic traits. This association is much stronger for the autonomic component of fibromyalgia (SSS) than for the extent of pain and tenderness (WPI), with fatigue and cognitive dysfunction prominent features. Our self-selected population consisted largely of younger females. As this demographic group now comprise most clinical consultations for each of food-related issues, fibromyalgia, fatigue, chronic pain and anxiety, the age and sex mix offer a window into the factors that might link these symptom complexes.

Women have significantly more tender musculoskeletal points than men [44]. Wolfe reported a higher prevalence of fibromyalgia in women than in men, although the differences were less marked among certain populations [5]. There are also important differences in perceived pain between the sexes [1, 45], and this equates to multisensory hypersensitivity in females with fibromyalgia [46]. This in turn impacts on psychosocial function [47] and may offer new therapeutic avenues [48, 49, 50]. In particular, the link with gastrointestinal features suggests that dietary modification may have a part to play in the treatment of fibromyalgia, especially in females [51]. For example, musculoskeletal, neurological, and psychiatric symptoms have all been associated with gluten consumption among people with no evidence of coeliac disease [52], and these features closely mimic those of fibromyalgia.

The bacterial community is altered in individuals with fibromyalgia, with an abundance of small subsets of certain species. Some of these have potentially relevant metabolic activity which could be relevant to the musculoskeletal symptoms [53]. A systematic review suggested that while more studies were needed, evidence supported the theory that the gut microbiota may play a role in fibromyalgia and that investigations into the relationship between the gut microbiota, gut dysfunction and fibromyalgia are warranted [54]. Chronic pain patients have benefitted from the development of a diet based on carbohydrates with low glycaemic index together with fruits and vegetables, yogurt, red wine, legumes and fish with occasional meat, eggs and cheese [55], while other workers have found evidence to support the use of olive oil, ancient grains, Mediterranean diet, glutamate and aspartame-free diet and a gluten-free diet in reducing symptoms of fibromyalgia [56]. A further systematic review of antioxidants in fibromyalgia suggested that over half of the studies assessed offered good evidence for efficacy of supplementation with vitamins and coenzyme Q10, and less consistent evidence for benefit from extra virgin olive oil and turmeric [57]. Vegan and FODMAP diets have produced some benefit in fibromyalgia [58] but significant differences in opinion persist at present [11, 12, 59]. Another systematic review found no benefit from dietary therapy in fibromyalgia, with patients reporting greater efficacy from acupuncture and physiotherapy [60]. However, many patients themselves prefer non-pharmacological therapies, particularly dietary interventions, which were reported to be more efficacious than drugs in a recent Italian study [61].

Table 1 Spearman's Correlation between the measures and food sensitivities, food allergies and food intolerances

	Food sensitivity	Food allergy	Food intolerance
Fibromyalgia (WPI + SSS)	0.240***	0.182***	0.380***
RAADS-R	0.172**	0.125*	0.148**
Beighton	0.036	0.135**	0.147**
WPI	0.233**	0.183**	0.358**
SSS	0.204**	0.153**	0.335**

Note: * $P<0.05$ (2-tailed), ** $P<0.01$ (2-tailed), *** $P<0.001$ (2-tailed)

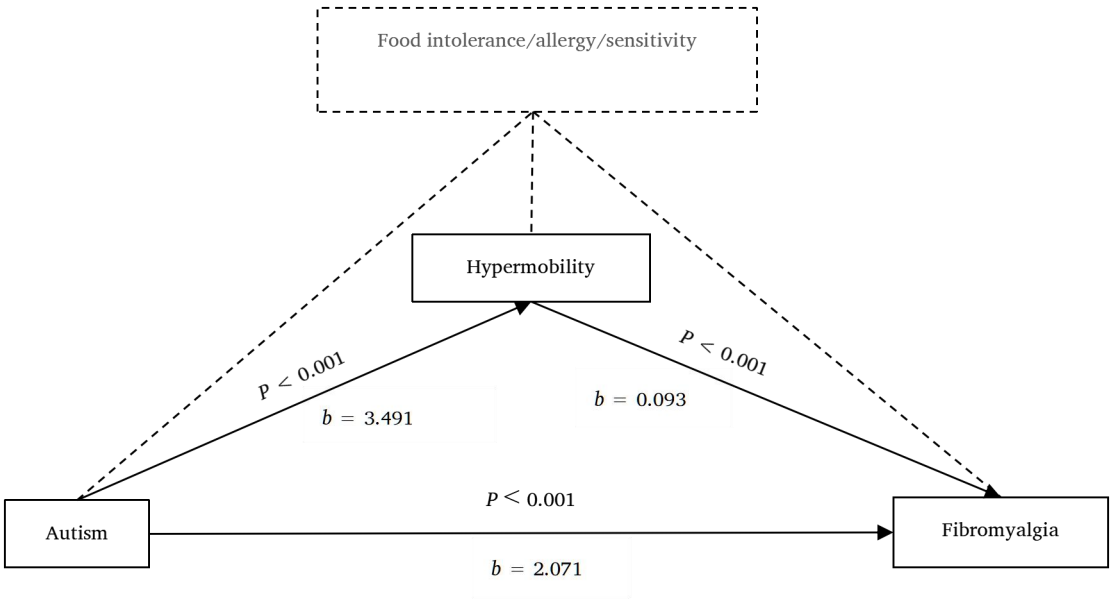

Figure 1. Proposed model for role of food intolerance or sensitivity in the relationship between autism, hypermobility and fibromyalgia

Recent work has confirmed that patients with chronic pain and especially fibromyalgia, are more likely to be neurodivergent [28, 30] and that autistic people often develop chronic musculoskeletal pain [29, 31]. This relationship also extends to close relatives [62], and hypermobility may mediate the association between fibromyalgia and autistic features [32], especially among symptomatic individuals [36, 40]. Most young females with autism or ADHD who also had hypermobility reported the development of chronic pain in adulthood [39, 41]. Musculoskeletal pain was described by 83% of people with hypermobility in one study, while autonomic and gastrointestinal symptoms were also reported by 70% and 71% of the same subjects [63]. A major overlap between fibromyalgia and chronic fatigue has been confirmed in people with hypermobility [64] and may also be a consequence of autonomic dysfunction. Indeed, hypersensitivity of the autonomic nervous system due to excitation of sympathetic and inhibition of parasympathetic nerves [65] can produce a range of clinical features in autism and is also very common in fibromyalgia [66]. Gastrointestinal dysfunction has been reported by 83% of autistic women [67], mirroring the prevalence in fibromyalgia [52, 53].

There is empirical evidence, along with scientific consensus, to support an association between food selectivity and autism [68]. Studies have reported a high prevalence of non-IgE-mediated food allergies in autistic children [69], and food selectivity often continues into adulthood, primarily driven by sensitivity around textures and tastes [70]. Although gluten sensitivity itself may present with gastrointestinal or neurological symptoms, a decade ago two studies concluded that there was insufficient evidence at that time to justify recommending a GFD to autistic children [17, 71]. However, the situation has evolved with increasing evidence that a GFD can produce improvement in autistic behaviours in those with allergies or intolerances to gluten [72]. There is strong anecdotal evidence of a benefit in many studies, although statistical analyses of the data are less convincing [73]. Most of the research has been conducted in autistic children and is therefore difficult to extrapolate to adults with confidence. There remains the danger of promoting ARFID in selected adults unless positive reinforcement is used appropriately [74], along with vitamin supplementation.

There is a dearth of scientific evidence on the effects of either lactose or alcohol consumption on fibromyalgia. The very limited available evidence suggests that alcohol may in fact be protective from chronic pain in moderate doses [75] but such an association cannot be assumed to relate to causation [76]. There is very limited evidence that the protein casein, found in dairy products, might exacerbate autistic features in children. A synopsis of the available data in 2014 was unable to reach a firm conclusion on the role of dairy-free diet in the management of autistic children [77].

Limitations

Self-reported surveys are always at risk of bias because of self-selection. Food related issues are subject to significant personal bias and our results were dependent on a questionnaire devised specifically for the study. No inter-observer error was calculated, and no tests of validity were made.

Inevitably the use of social media makes it difficult to avoid the potential for bias when subjects have not been independently screened for existing diagnoses. We avoided advertising on certain platforms (eg. online autism forums) and the use of hashtags that night have attracted certain groups. Other limitations relate to the measures we adopted, all of which were self-reported questionnaires. These may decrease internal validity as participants could either exaggerate or underreport symptoms. As clinicians usually assess hypermobility, the accuracy of participant's self-diagnosis cannot be guaranteed. Alternative measures validated for use in large population studies should be considered for future studies.

Future Research

Chronic musculoskeletal pain is a common comorbidity among those with autistic traits and hypermobility. Food related issues, especially intolerance, are associated with heightened levels of symptomatology even within a self-selected community population, largely comprised of younger females. Intolerance to gluten, lactose and alcohol correlate most closely with symptoms of dysautonomia and further research is needed to assess whether this relationship can be demonstrated in patient populations with confirmed fibromyalgia. Exploration of the mechanisms for this association is needed, in the hope that there may be support for further formal clinical trials of exclusion of specific dietary elements in those who report adverse advents associated with their consumption.

Conclusions

In conclusion, our study has demonstrated the potential for a relationship between food-related symptoms of intolerance or sensitivity, and features of fibromyalgia among a self-selected community population comprised chiefly of young females. Food

related concerns were most often provoked by gluten and lactose and were more often manifested as gastrointestinal symptoms than musculoskeletal pain. However, a significant group (1 in 6) of participants did report that certain foods were associated with worsening of symptoms of fibromyalgia. Given the significant association of autistic traits with fibromyalgia in this population, with indirect evidence of significant autonomic dysfunction, it is possible that certain foodstuffs trigger fibromyalgia in some individuals as a result of their antigenic effects on an immune system rendered susceptible by autonomic hypersensitivity within the gastrointestinal tract.

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