Vilnius University Press

Contents lists available at Vilnius University Press

Neurologijos seminarai
2025, 29(103), pp. 42–52

ISSN ISSN 1392-3064 / eISSN 2424-5917
DOI: https://doi.org/10.15388/NS.2025.29.103.4

Apžvalginis mokslinis straipsnis / Review Article

Clinical and Patient-Reported Effects of Ketogenic Diet and Intermittent Fasting for Multiple Sclerosis: Literature Review

Greta Ramonaitė*
Faculty of Medicine, Vilnius University, Vilnius, Lithuania
https://orcid.org/0009-0007-7423-0203

Ieva Sereikė
Clinic of Neurology and Neurosurgery, Institute of Clinical Medicine, Faculty of Medicine, Vilnius University, Vilnius, Lithuania

Summary. Multiple sclerosis is the most common chronic inflammatory autoimmune disease affecting the central nervous system. Its prevalence is increasing, with an estimated 2.8 million people affected worldwide. The development of multiple sclerosis is associated with various factors, including Epstein-Barr virus, ultraviolet B radiation, smoking, vitamin D deficiency, and genetic predisposition. This disease is more prevalent in Western countries, thereby indicating that nutrition might be an additional risk factor, as typical Western diets high in energy, saturated fats, and sugars are linked to neuroinflammation.

Ketogenic diet and intermittent fasting have shared aspects, as ketogenic diet was created to replicate the effects of fasting. Patients demonstrate a considerable interest in these dietary approaches – as diet is the most frequently searched self-management strategy among individuals with multiple sclerosis, according to internet search data. When it comes to the effects of these diets for multiple sclerosis patients, ketogenic diet tends to provide more consistent improvements in physical, cognitive, and emotional symptoms, while intermittent fasting mainly enhances cognition and the quality of life. Both diets appear to be safe and feasible, with mostly mild and temporary side effects, although the disease duration, disability level, and relapse rate may influence the likelihood of adverse events.

This literature review explores the effects of ketogenic diet and intermittent fasting for multiple sclerosis patients, including symptom, metabolic, and body composition changes, as well as adverse events, patient perceptions and adherence challenges.
Keywords: ketogenic diet, intermittent fasting, multiple sclerosis.

Ketogeninė dieta ir protarpinis badavimas sergant išsėtine skleroze: klinikiniai ir pacientų nurodyti poveikiai. Literatūros apžvalga

Santrauka. Išsėtinė sklerozė yra dažniausia lėtinė uždegiminė autoimuninė liga, pažeidžianti centrinę nervų sistemą. Išsėtinės sklerozės paplitimas didėja – visame pasaulyje ja serga apie 2,8 milijono žmonių. Šios ligos vystymasis siejamas su įvairiais veiksniais, įskaitant Epšteino ir Bar (Epstein-Barr) virusą, ultra-

* Corresponding author. Greta Ramonaitė, Vilnius University, Faculty of Medicine, Čiurlionio 21, LT-03101, Vilnius, Lithuania.
E-mail: greta.ramonaite1@gmail.com

Received: 30/10/2025. **Accepted:** 03/01/2026

violetinę B spinduliuotę, rūkymą, vitamino D trūkumą ir genetinį polinkį. Ši liga labiau paplitusi Vakarų šalyse, o tai rodo, kad mityba taip pat gali būti vienas iš rizikos veiksnių, nes tipiškos vakarietiškos dietos, kuriose gausu energijos, sočiųjų riebalų ir cukrų, yra susijusios su neuroužd egimu.

Ketogeninė dieta ir protarpinis badavimas turi bendrų bruožų, nes ketogeninė dieta buvo sukurta siekiant atkartoti badavimo poveikį. Pacientai rodo didelį susidomėjimą šiomis dietomis – remiantis interneto paieškos duomenimis, dieta yra dažniausiai išsėtine skleroze sergančių asmenų ieškoma savarankiško ligos valdymo strategija. Kalbant apie šių dietų poveikį išsėtine skleroze sergantiems pacientams, ketogeninė dieta paprastai labiau siejama su fizinių, kognityvinių ir emocinių simptomų pagerėjimu, o protarpinis badavimas daugiausia gerina pažinimą ir gyvenimo kokybę. Abi dietos atrodo saugios ir įgyvendinamos, o jų šalutinis poveikis dažniausiai yra nestiprus ir laikinas, nors ligos trukmė, negalios lygis ir paūmėjimų dažnis gali turėti įtakos nepageidaujamų reiškinių tikimybei.

Šioje literatūros apžvalgoje nagrinėjamas ketogeninės dietos ir protarpinio badavimo poveikis išsėtine skleroze sergantiems pacientams, įskaitant simptomų, metabolinius, kūno sudėties pokyčius, taip pat šalutinius poveikius bei pacientų suvokimą ir gydymo režimo laikymosi sunkumus.
Raktažodžiai: ketogeninė dieta, protarpinis badavimas, išsėtinė sklerozė.

Introduction

Multiple Sclerosis (MS) is the most common chronic inflammatory autoimmune disease of the central nervous system in young adults [1,2]. It has a rising prevalence, and it is estimated that 2.8 million people worldwide are affected [3]. Various factors, such as Epstein-Barr virus, ultraviolet B (UVB) radiation, smoking, vitamin D deficiency, and genetics, are associated to MS development. As indicated by migration studies, the environment plays a larger role than genetics [1]. The fact that MS is more common in Western countries shows that nutrition very well might be among the environmental MS risk factors, as, for example, the usual Western diets high in energy, saturated fats, and sugars are linked to neuroinflammation [2]. Currently, however, there are no specific diet recommendations for MS patients [4].

Ketogenic Diet (KD) and *Intermittent Fasting* (IF) have shared aspects, as KD and IF both significantly reduce the carbohydrate intake. The resulting increase in ketone bodies may facilitate the regeneration of demyelinated axons; therefore, these dietary interventions may be beneficial for patients with MS [2,5]. Additionally, KD was created to replicate the effects of fasting and has been used to treat epilepsy in children since the 1920s, subsequently demonstrating positive outcomes in a wider range of neurological disorders, such as Alzheimer's disease and Parkinson's disease [6,7].

When it comes to MS, studies also demonstrate positive effects of these diets. Patients have been showing a high interest since the diet is the most frequently searched self-management strategy among individuals with MS, according to internet search data [8]. Given the popularity, possible significant positive effects, and the similarities between KD and IF, a review of both KD and IF for MS patients seems justified.

Research Aim

To identify the effects of KD and IF for people with MS and to clarify a direction for future research by reviewing recent studies.

Materials and Methods

A literature review was conducted by using *PubMed* and *Google Scholar* databases. The following keywords were used for the search: multiple sclerosis, multiple sclerosis AND diet, fasting AND

multiple sclerosis, ketogenic diet AND multiple sclerosis. Relevant human studies, published between 2019 and 2025, were selected for review. The analyzed studies varied in duration and examined different modifications of KD and IF, as presented in Table 1.

Table 1. Diet types and trial duration of reviewed studies.

Author	Diet	Study duration
Brenton et al. [9]	Modified Atkins KD	6 months
Lee et al. [10]	Medium-chain triglyceride-based KD (Wahls Paleo Plus™)	12 weeks
Perlman et al. [11]	Modified Atkins KD	6 months
Merlino et al. [12]	2:1 KD	6 months
Oh et al. [13]	KD	6 months
Wetmore et al. [14]	Modified Atkins KD	6 months + 3-month post-diet study visit
Etemadifar et al. [15]	Ramadan fasting (14-hour daily fasting period)	1 month
Wingo et al. [16]	Time-restricted eating (16-hour daily fasting period)	8 weeks
Hassan et al. [17]	Ramadan fasting (14.5-hour daily fasting period)	1 month
Roman et al. [18]	Time-restricted eating	24 weeks
Bock et al. [19]	A single cycle of seven-day caloric restriction (200–350 kcal/d) and AKD (<50 g/day of carbohydrates, >160 g/day of fat, ≤100 g/day of protein)	6 months

Note. KD, ketogenic diet; AKD, adapted ketogenic diet.

Results

Changes in MS symptoms

Many different symptoms can be present in patients with MS, and these symptoms, as well as the disability status as a whole, are assessed by using several rating scales [20]. One notable symptom, specifically, fatigue, which is evaluated by using tools such as the *Modified Fatigue Impact S*cale (MFIS) and the *MS Fatigue Severity Scale* (MSFSS), has been reported to significantly decrease after six months on a Modified Atkins KD [9]. Another symptom of MS, depression, assessed by the *Depression Anxiety Stress Scale-21* (DASS-21) and Beck's Depression Inventory 1A (BDI) in the reviewed studies, was reported to be significantly decreased, indicating that the psychological status of patients on KD improved [9,12]. Additionally, KD seems to reduce anxiety and stress symptoms by improving the sleep quality [12]. This is important because the emotional status is the major predictor of the quality of life (QoL) in MS patients [21]. In a study by Brenton et al., QoL scores for MS patients on KD increased due to improvements in both physical and mental health, and were even better compared to some drug clinical trials [9]. A study by Merlino et al. revealed that almost all the *Multiple Sclerosis Quality of Life 54* (MSQOL-54) subscales improved for patients on KD, with significant differences observed in role limitations – physical, emotional well-being, energy, cognitive function, the overall quality of life, and change in health [12]. Improvement was also observed in assessments evaluating motor skills and functional mobility, specifically, in the *Nine-Hole Peg Test* (9-HPT) speed and *6-Minute Walk* (6-MW) distance. The *Expanded Disability Status Scale* (EDSS), a rating scale that ranges in half-point increments from 0 (normal neurologic examination) to 10 (death due to MS), was also noted to be reduced [9,20].

Participants in a study by Wetmore et al. reported an improvement of MS-related symptoms on KD (47%) including: paresthesias/pain (41%), numbness (15%), balance (15%), frequency or severity of headaches (15%), urinary urgency (7%), muscle spasms (4%), and vision (4%). Also, 23% of participants were able to reduce and/or discontinue medications for symptomatic treatment of attention, pain, spasticity, and headaches. This study also demonstrated that patient-reported and clinical outcomes, such as fatigue impact (as measured by MFIS), depression (measured by BDI), and the physical quality of life (as measured by MSQOL-54) at three months post-trial remained significantly improved compared to the baseline, although they were slightly reduced compared to six months on KD. Interestingly, the *Paced Auditory Serial Addition Test* (PASAT), the *Symbol Digit Modality Test* (SDMT), and 6-MW were further improved at three months after KD compared to six months on KD [14]. These findings suggest that some cognitive and physical symptoms may stay improved or continue to improve after the initial period of dietary intervention, thereby indicating that KD could have a lasting positive impact. In contrast, a study by Lee et al., where patients followed a modified medium-chain triglyceride-based KD, did not find any significant improvements in the MFIS score, EDSS scores, or the 9-HPT test. In this study the control group (the usual diet) scores showed a decrease in the mental and physical quality of life, although these changes did not translate to increased disability, as there were no significant changes in the EDSS scores. The fact that there were no significant positive changes in this study could be attributed to a ketogenic ratio (a ratio of the sum of ketogenic factors to the sum of the antiketogenic factor) of about 1:1 achieved by the KD group, which is lower than the traditional ratio of 4:1 and a short duration, as the benefits of a dietary intervention may take longer than 12 weeks to affect the cognitive or physical function [10].

When looking into IF for MS patients, a Ramadan fasting study by Etemadifar et al. did not reveal any statistically significant differences between the mean total score of MSIF before and after fasting; however, significant changes were observed in the cognitive domain scores, suggesting that cognitive aspects may be more sensitive to the effects of fasting. The quality of life in this study was also shown to be positively affected by IF, with significant increases in the mean physical health and mental health composites. When MSQOL-54 subscale scores were assessed, the results revealed statistically significant increases in the following subscales: role limitations due to emotional problems, emotional well-being, energy, health perception, and the sexual function [15]. Participants in a study by Wingo et al., which aimed to determine the feasibility and acceptability of *Time-Restricted Eating* (TRE), were asked to complete satisfaction surveys. Better sleep was noted by two participants, and having more energy, feeling better overall, reduced acid reflux, weight loss, being more mindful of what they ate, and drinking more water were noted by a single participant. In addition, SDMT scores and 9-HPT speed improved, while the total pain scores decreased. Fatigue scores on the MFIS indicated a slight improvement in psychosocial fatigue, however, fatigue measured by the MSFSS did not improve. Despite some positive effects, no clinically meaningful differences for patients following TRE were found in the mood, anxiety, or sleep scores, thus highlighting the complex nature of mental health, and possibly suggesting a need for better-suited approaches [16]. Similarly, Roman and colleagues found no significant change over the six-month study period between the TRE and control groups in any of the patient-reported outcomes (fatigue, sleep quality, quality of life) [18]. Varying findings between studies may be attributed to differences in the study design, participant characteristics, diet, and adherence. Also, it might be worth noting that MS patients often do not have conveniently measurable indicators of clinical efficacy, such as the percentage of seizure reduction, as in epilepsy, for example. This is especially true if they do not experience relapses, which means that the benefits of a diet for MS may be under-recognized [14].

Impact on sleep

Sleep disorders, such as sleep disordered breathing, insomnia, *Rapid Eye Movement* (REM) sleep behaviour disorder, narcolepsy, and restless legs syndrome, are common in people with MS and may negatively impact their quality of life – specifically, a polysomnographic study of 66 patients revealed that 74% were affected [22,23]. Notably, fatigue itself, as the most common symptom of MS, has been correlated with sleep problems [23]. Ketogenic diets are known to affect sleep by modulating sleep–wake cycles, circadian rhythm, and sleep stages [24]. Studies of KD specifically for MS patients also demonstrate changes in sleep-related parameters. A study by Perlman et al. observed a mean reduction in the *Epworth Sleepiness Scale* (ESS) score, which also correlated with improvements in the fatigue severity, depression, and quality of life scores, as well as a decrease in the frequency of *Excessive Daytime Sleepiness* (EDS) (i.e., ESS score >10) [11]. Furthermore, a study by Merlino et al. demonstrated that KD improved all sleep complaints, the number of MS patients affected by poor sleep was more than halved, and the prevalence of EDS, as well as ESS scores, decreased [12]. The global *Pittsburgh Sleep Quality Index* (PSQI) scores, which were demonstrated to be an independent predictor of anxiety, stress, and mental health, were significantly decreased after KD. Improvements were observed in all the PSQI domains (sleep quality, sleep onset latency, sleep duration, sleep efficiency, sleep disturbance, and daytime dysfunction) [12]. Perlman et al. also employed the Total *Sleep Disorders Symptom* Checklist-25 (SDS), and its score decreased, with improvements noted in insomnia, obstructive sleep apnea, and restless leg syndrome. A reduction in the total SDS score correlated with improvements in the fatigue impact, depression, and quality of life physical scores [11]. No change in sleep duration was observed, which is consistent with recent findings showing that insomnia and perceptions of poor sleep have a stronger link to fatigue in multiple sclerosis than the objective sleep duration [11,25]. Notably, KD-induced improvements in sleep disorders common in MS patients were independent of changes in the *Body Mass Index* (BMI) [11,12]. However, some studies did not observe any sleep benefits for MS patients on KD, as mentioned earlier, indicating that the relationship between diet and sleep may be complex and/or that not all studies may be able to detect the effects of KD on sleep [16,18].

IF (specifically, TRE) for MS patients was not significantly associated with changes in the sleep quality, as observed by Wingo and colleagues [16]. A review of the impact of popular fasting diets on sleep by McStay et al. also revealed that these diets lack effect, by noting that more weight loss may be required to see improvements [26].

Impact on the serum neurofilament light chain

Serum *Neurofilament Light* chain (NfL), a biomarker of neuroaxonal injury, has been shown to correlate with the MS activity [27]. Additionally, the NfL level has been observed to correlate with age and disease duration [19]. A study by Oh et al. demonstrated that higher levels of ketosis led to greater reductions in NfL for MS patients on KD, which suggests that the degree of ketosis, specifically, as opposed to macronutrient restriction and/or weight loss, may be responsible for decreasing neuroaxonal injury. However, in this study, the change in NfL did not correlate with the change in clinical outcome metrics (MS Functional Composite, SDMT, 6-MW) or patient-reported outcomes (fatigue, depression, and the quality of life) [13]. This may be explained by the fact that clinical and patient-reported outcome metrics are less sensitive and require more time to show a meaningful change. Given this, it is also important to note that the extent of variation indicating a clinically meaningful change in NfL measurements has not yet been defined. Bock

et al. reported comparable findings, with reduced NfL levels observed at six months on AKD, suggesting potential neuroprotective effects in MS. However, NfL levels did not significantly correlate with BMI, EDSS, MSQOL-54, FSS, MFIS, or BDI [19].

In the same study by Bock et al., a single cycle of seven-day caloric restriction (200–350 kcal/d) did not affect NfL, thus indicating that fasting and similar diets may have a lesser effect on NfL than KD. However, the diet duration could also explain the differing results between diets, and consequently suggesting that additional studies are required [19].

Anthropometric and metabolic changes

An elevated body mass index (BMI), particularly obesity (BMI ≥30 kg/m^2), is associated with an increased multiple sclerosis (MS) severity and poorer clinical outcomes, indicating that effective obesity management can improve patient prognosis [28]. Recent studies have demonstrated that adherence to a ketogenic diet results in significant reductions in BMI and fat mass, and these changes may contribute to increased vitamin D bioavailability [9,10,12,14]. This effect represents a potential additional benefit of the ketogenic diet, given that vitamin D has been shown to slow the progression of MS [29]. In the study by Wetmore et al., BMI and waist circumference were significantly lower at six months among those individuals who maintained strict or liberalized ketogenic diets compared to those who adopted alternative dietary approaches. Additionally, these variables continued to improve three months after the trial, although to a lesser extent than six months on KD [14]. Furthermore, patients following a ketogenic diet exhibited significant reductions in fasting insulin, fasting glucose, and hemoglobin A1c, supporting the role of the ketogenic diet in improving glucose metabolism. This is significant because insulin resistance is prevalent among MS patients and is associated with increased disability [9,10,30].

When it comes to IF, no significant changes in weight and body composition for MS patients were observed in the reviewed studies [16,18]. However, a recent review by Nowosad and Sujka revealed that different fasting diets were associated with a reduced body weight, fasting insulin, fasting glucose, and hemoglobin A1c [31]. The difference in results may be explained by the fact that this review included studies which were conducted on overweight and obese people, and the fact that it included various fasting diets. Also, the duration of these diet studies could have been an additional factor that led to conflicting results.

Adipokine changes

Adipokines are bioactive molecules secreted by the adipose tissue. They play a crucial role in modulating immune and metabolic pathways in MS patients, influencing the functions of T-cells, glial cells, and the blood-brain barrier. Increased levels of leptin, a pro-inflammatory adipokine, are correlated with MS relapses, lesion volume, and disability [32]. Additionally, leptin plays a role in coordinating sleep-wake states [33]. In contrast, an anti-inflammatory adipokine, adiponectin, is correlated with a higher brain volume and neuroprotection, and is present in lower levels in MS patients compared to healthy controls, tus suggesting that adiponectin deficiency may exacerbate demyelination [32]. A reduction in leptin and an increase in adiponectin were observed in patients following a ketogenic diet, although this change may partly be attributed to changes in BMI [9,14]. Nonetheless, the ketogenic diet helps achieve a beneficial balance of these adipokines not only during the diet course, but also up to three months post-diet. A study by Wetmore et al. demonstrated that leptin remained significantly reduced compared to the baseline, even though it was higher than at 6 months on KD. Adiponectin remained significantly higher post-diet compared to the baseline as well [14].

When looking into IF, other studies showed that it also exerts a favorable effect by increasing adiponectin and decreasing leptin levels [34]. In contrast, a study by Faris and colleagues found that Ramadan fasting was associated with increased leptin and decreased adiponectin levels. However, these conflicting findings may be due to the differences in the diet and other lifestyle factors among people living in different parts of the world, as well as differences in the study design [35].

Undesirable effects

KD, like other treatment methods, comes with side effects, some of the most frequent ones being nausea, dizziness, polyurea, and lethargy, all of which have different intensities and are most prominent in the first few days of KD [36]. A study by Brenton and colleagues revealed some side effects of KD specifically for MS patients. The most common one was constipation, followed by diarrhea, nausea, weight gain, fatigue, worsening of depression or anxiety, acne, and menstrual irregularities; however, these side effects were observed only in the two initial weeks. Furthermore, no participants experienced relapses during the six-month study, thus indicating that KD may be effective [9].

Common adverse events of IF have been shown to be headaches, lethargy, mood swings, dizziness, and polyuria [37]. When looking into adverse events for MS patients specifically, a study of TRE by Roman et al. reported none [18]. In a study by Wingo et al., two participants reported feeling that they had to modify their social life, working hours, and family schedule to accommodate their eating window, which was perceived as an adverse effect of TRE. Constipation, headache, and weight gain were also each noted by one participant, however, no serious adverse events were reported [16]. In contrast, a study by Hassan et al. found that approximately 13% of patients experienced relapses, about 17% experienced symptom exacerbation (including fatigue, weakness, dizziness, headache, and spasticity), and about 7% developed new symptoms (such as fatigue, dizziness, and constipation) during Ramadan fasting. Additionally, the study by Hassan and colleagues found that 65% of patients experienced the same adverse events they had before Ramadan with their *Disease-Modifying Therapy* (DMT); however, about 32% of patients reported worsening of these adverse events. Patients with MS who experienced any of these had a significantly longer disease duration and a significantly higher EDSS compared to those who did not experience any of these. Additionally, the occurrence of relapses, exacerbation of symptoms, and development of new symptoms during Ramadan was significantly higher in patients who experienced relapses in the preceding year compared to those who did not. Overall, however, Ramadan fasting did not appear to have a negative impact on MS patients with short disease duration, mild disability, and infrequent relapses [17]. Previously mentioned studies had stricter eligibility criteria, which may have led to less generalizable results, explaining the conflicting findings [16,18]. Patients with relapsing-remitting MS (RRMS) were found to have a significantly higher relapse activity when compared to patients with secondary progressive MS (SPMS) and primary progressive MS (PPMS); however, this could be due to the fact that progressive forms of MS tend to be less active when it comes to relapses. Nevertheless, there were no statistically significant differences between the MS types in the exacerbation of symptoms or the development of new symptoms. In the same study, patients were also compared based on their country of residence, and the analysis revealed that those living in Morocco had a significantly lower relapse rate, fewer exacerbations of symptoms, and fewer occurrences of new symptoms during Ramadan fasting compared to those residing in Egypt and Saudi Arabia. This finding may indicate a need for additional region-based studies, as geographical, climatic, cultural, and healthcare factors may contribute to the effects of fasting diets [17].

Diet adherence

Adherence plays a significant role in the success of diet therapy. However, it can be seen as a substantial challenge as it has been demonstrated with epilepsy patients – in the sense that adherence to KD was about 66% in the short term with a further decrease over time [38]. Adherence may be important not only during diet trials, but also after them. A study by Wetmore et al., which evaluated the adherence rates to a KD in MS patients three months after a KD trial, revealed that, despite a high subject interest in continuing with a KD at the end the trial (91%), 21% reported continued adherence to a strict KD and 37% reported adhering to a less restrictive form of the KD. However, whether the less restrictive KD adherence counts could be debated because it is unclear if the liberalized KD has the same effects as the original studied diet. When looking into the reasons why some patients continued to adhere to KD while others did not, it was found that subjects with greater reductions in BMI and fatigue at six months on the diet were more likely to continue KD after the trial. Even though most participants stated that they would recommend the KD to their friends with MS, they also reported some obstacles, the most significant being avoidance of particular foods (49%), difficulty maintaining the KD while traveling/eating out (13%), lack of accountability (11%), time management challenges (4%), and pandemic-related barriers (4%) [14].

When it comes to adherence to IF for people with MS, a Ramadan fasting study by Hassan et al. revealed that around 89% of the participants were able to fast approximately 14.5 hours daily for nearly the entire month [17]. Also, adherence to the TRE diet in a study by Roman et al. was relatively good [18]. In a study by Wingo et al., at the endpoint, 50% of the responders indicated that they were planning to continue TRE, but noted that they would make some adjustments to fit their lifestyle better [16]. In slight contrast, a study by Jefcoate et al. on people without MS found TRE adherence was about 60% per week, indicating that, when seeking to maximize the potential benefits which fasting diets may provide, additional measures to increase adherence, like personalizing TRE protocols, should be considered [39].

Additional patient perceptions

The most beneficial aspects of KD noted by the subjects, as identified by Wetmore and colleagues, were weight loss, increased energy/focus, satisfaction with improved health, improved sleep, and fewer headaches. On the other hand, the most challenging aspects of this diet were avoiding typical foods/ingredients, trouble adhering to the KD when eating out, difficulty increasing the overall fat intake, the challenge of following the KD alone, and lower energy levels. For those who had previously tried a structured diet, they were asked if the KD was easier or harder, and nearly a half thought the KD was easier than their past diet attempts, while 25% considered it of equal difficulty, and 28% found it more challenging. Also, the study diet was reported as being more costly (by 63%) than other diets patients followed previously, which could be especially significant for some patients when following KD outside of clinical trial settings, which is an additional factor to consider [14].

When it comes to IF, a study by Rathomi et al., exploring motivation for starting TRE, although not conducted on subjects with MS, revealed some key themes: dissatisfaction with prior or traditional approaches, perceived broader health benefits, principles of TRE deemed logical, low or no cost of adoption, manageable psychosocial barriers, being non-restrictive and easy to use, and compatibility with the personal lifestyle. These findings are important because the knowledge of motivating factors may be crucial not only when aiming to start the diet, but also for sustained adherence [40].

Conclusions

The evidence of KD for MS patients is more extensive compared to IF, but both diets demonstrate promising positive effects. KD shows more consistent improvements across physical, cognitive, and emotional symptoms, and IF mainly benefits the cognitive function and the quality of life. According to reviewed studies, both diets seem safe and feasible for MS patients, with most side effects being mild and temporary. However, factors such as the disease duration, disability level, and relapse rate may influence the likelihood of adverse events. Despite limitations of the reviewed studies, the overall positive effects seem to outweigh the negatives. Therefore, KD and/or IF may be beneficial for MS patients, although larger, longer-term studies directly comparing KD and IF across different MS subtypes and geographic regions are still needed.

Author contributions

Greta Ramonaitė: conceptualization, methodology, writing – original draft, writing – review and editing.
Ieva Sereikė: conceptualization, methodology, supervision, writing – review and editing.

References

1. Dobson R, Giovannoni G. Multiple sclerosis – a review. Eur J Neurol 2019; 26(1): 27–40. doi: 10.1111/ene.13819
2. Bahr LS, Bock M, Liebscher D, Bellmann-Strobl J, Franz L, Prüß A, et al. Ketogenic diet and fasting diet as Nutritional Approaches in Multiple Sclerosis (NAMS): Protocol of a randomized controlled study. Trials 2020; 21(1): 3. doi: 10.1186/s13063-019-3928-9
3. Walton C, King R, Rechtman L, Kaye W, Leray E, Marrie RA, et al. Rising prevalence of multiple sclerosis worldwide: Insights from the Atlas of MS, third edition. Mult Scler J 2020; 26(14): 1816–21. doi: 10.1177/1352458520970841
4. Evans E, Levasseur V, Cross AH, Piccio L. An overview of the current state of evidence for the role of specific diets in multiple sclerosis. Mult Scler Relat Disord 2019; 36: 101393. doi: 10.1016/j.msard.2019.101393
5. Storoni M, Plant GT. The therapeutic potential of the ketogenic diet in treating progressive multiple sclerosis. Mult Scler Int 2015; 2015: 1–9. doi: 10.1155/2015/681289
6. Kossoff EH. More fat and fewer seizures: Dietary therapies for epilepsy. Lancet Neurol 2004; 3(7): 415–20. doi: 10.1016/S1474-4422(04)00807-5
7. Pietrzak D, Kasperek K, Rękawek P, Piątkowska-Chmiel I. The therapeutic role of ketogenic diet in neurological disorders. Nutrients 2022; 14(9): 1952. doi: 10.3390/nu14091952
8. Silveira SL, Richardson EV, Motl RW. Desired resources for changing diet among persons with multiple sclerosis: Qualitative inquiry informing future dietary interventions. Int J MS Care 2022; 24(4): 175–83. doi: 10.7224/1537-2073.2021-052
9. Brenton JN, Lehner-Gulotta D, Woolbright E, Banwell B, Bergqvist AGC, Chen S, et al. Phase II study of ketogenic diets in relapsing multiple sclerosis: Safety, tolerability and potential clinical benefits. J Neurol Neurosurg Psychiatry 2022; 93(6): 637–44. doi: 10.1136/jnnp-2022-329074
10. Lee JE, Titcomb TJ, Bisht B, Rubenstein LM, Louison R, Wahls TL. A modified MCT-based ketogenic diet increases plasma β-hydroxybutyrate but has less effect on fatigue and quality of life in people with multiple sclerosis compared to a modified paleolithic diet: A waitlist-controlled, randomized pilot study. J Am Coll Nutr 2021; 40(1): 13–25. doi: 10.1080/07315724.2020.1734988
11. Perlman J, Wetmore E, Lehner-Gulotta D, Banwell B, Bergqvist AGC, Coleman R, et al. Impact of a ketogenic diet on sleep quality in people with relapsing multiple sclerosis. Sleep Med 2024; 122: 213–20. doi: 10.1016/j.sleep.2024.08.020

12. Merlino G, Garbo R, Dal Bello S, Del Negro I, Lamon E, Filippi F, et al. Ketogenic diet may improve sleep quality and daytime somnolence in patients affected by multiple sclerosis. Results of an exploratory study. Sleep Med 2023; 112: 181–7. doi: 10.1016/j.sleep.2023.10.016
13. Oh U, Woolbright E, Lehner-Gulotta D, Coleman R, Conaway M, Goldman MD, et al. Serum neurofilament light chain in relapsing multiple sclerosis patients on a ketogenic diet. Mult Scler Relat Disord 2023; 73: 104670. doi: 10.1016/j.msard.2023.104670
14. Wetmore E, Lehner-Gulotta D, Florenzo B, Banwell B, Bergqvist AGC, Coleman R, et al. Ketogenic diet in relapsing multiple sclerosis: Patient perceptions, post-trial diet adherence & outcomes. Clin Nutr 2023; 42(8): 1427–35. doi: 10.1016/j.clnu.2023.06.029
15. Etemadifar M, Sayahi F, Alroughani R, Toghianifar N, Akbari M, Nasr Z. Effects of prolonged fasting on fatigue and quality of life in patients with multiple sclerosis. Neurol Sci 2016; 37(6): 929–33. doi: 10.1007/s10072-016-2518-9
16. Wingo BC, Rinker JR, Green K, Peterson CM. Feasibility and acceptability of time-restricted eating in a group of adults with multiple sclerosis. Front Neurol 2023; 13: 1087126. doi: 10.3389/fneur.2022.1087126
17. Hassan A, Merghany N, Ouchkat F, Regragui W, Kedah H, Hamdy SM, et al. Impact of Ramadan fasting on disease activity in patients with multiple sclerosis: A multicenter study. Nutr Neurosci 2021; 1–10. doi: 10.1080/1028415x.2021.2006955
18. Roman SN, Fitzgerald KC, Beier M, Mowry EM. Safety and feasibility of various fasting-mimicking diets among people with multiple sclerosis. Mult Scler Relat Disord 2020; 42: 102149. doi: 10.1016/j.msard.2020.102149
19. Bock M, Steffen F, Zipp F, Bittner S. Impact of dietary intervention on serum neurofilament light chain in multiple sclerosis. Neurol Neuroimmunol Neuroinflamm 2022; 9(1): e1102. doi: 10.1212/nxi.0000000000001102
20. Files DK, Jausurawong T, Katrajian R, Danoff R. Multiple sclerosis. Prim Care Clin Off Pract 2015; 42(2): 159–75. doi: 10.1016/j.pop.2015.01.007
21. Jaracz K, Pawlak M, Górna K, Kołcz B, Wołoszyn D, Kozubski W. Quality of life and social support in patients with multiple sclerosis. Neurol Neurochir Pol 2010; 44(4): 358–65. doi: 10.1016/S0028-3843(14)60295-4
22. Veauthier C, Radbruch H, Gaede G, Pfueller C, Dörr J, Bellmann-Strobl J, et al. Fatigue in multiple sclerosis is closely related to sleep disorders: A polysomnographic cross-sectional study. Mult Scler J 2011; 17(5): 613–22. doi: 10.1177/1352458510393772
23. Brass SD, Duquette P, Proulx-Therrien J, Auerbach S. Sleep disorders in patients with multiple sclerosis. Sleep Med Rev 2010; 14(2): 121–9. doi: 10.1016/j.smrv.2009.07.005
24. O'Hearn LA. The therapeutic properties of ketogenic diets, slow-wave sleep, and circadian synchrony. Curr Opin Endocrinol Diabetes Obes 2021; 28(5): 503–8. doi: 10.1097/MED.0000000000000660
25. Bhattarai J "Jackie," Patel KS, Dunn KM, Brown A, Opelt B, Hughes AJ. Sleep disturbance and fatigue in multiple sclerosis: A systematic review and meta-analysis. Mult Scler J – Exp Transl Clin 2023; 9(3): 20552173231194352. doi: 10.1177/20552173231194352
26. McStay M, Gabel K, Cienfuegos S, Ezpeleta M, Lin S, Varady KA. Intermittent fasting and sleep: A review of human trials. Nutrients 2021; 13(10): 3489. doi: 10.3390/nu13103489
27. Disanto G, Barro C, Benkert P, Naegelin Y, Schädelin S, Giardiello A, et al. Serum neurofilament light: A biomarker of neuronal damage in multiple sclerosis. Ann Neurol 2017; 81(6): 857–70. doi: 10.1002/ana.24954
28. Lutfullin I, Eveslage M, Bittner S, Antony G, Flaskamp M, Luessi F, et al. Association of obesity with disease outcome in multiple sclerosis. J Neurol Neurosurg Psychiatry 2023; 94(1): 57–61. doi: 10.1136/jnnp-2022-329685
29. Camu W, Lehert P, Pierrot-Deseilligny C, Hautecoeur P, Besserve A, Jean Deleglise AS, et al. Cholecalciferol in relapsing-remitting MS: A randomized clinical trial (CHOLINE). Neurol Neuroimmunol Neuroinflamm 2019; 6(5): e597. doi: 10.1212/NXI.0000000000000597
30. Ruiz-Argüelles A, Méndez-Huerta MA, Lozano CD, Ruiz-Argüelles GJ. Metabolomic profile of insulin resistance in patients with multiple sclerosis is associated to the severity of the disease. Mult Scler Relat Disord 2018; 25: 316–21. doi: 10.1016/j.msard.2018.08.014

31. Nowosad K, Sujka M. Effect of various types of intermittent fasting (IF) on weight loss and improvement of diabetic parameters in human. Curr Nutr Rep 2021; 10(2): 146–54. doi: 10.1007/s13668-021-00353-5
32. Ghaffary EM, Bjørklund G, Bhat RS, Mirmosayyeb O. Adipokines in multiple sclerosis: Immune dysregulation, neuroinflammation, and therapeutic opportunities. Autoimmun Rev 2025; 24(8): 103825. doi: 10.1016/j.autrev.2025.103825
33. Mosavat M, Mirsanjari M, Arabiat D, Smyth A, Whitehead L. The role of sleep curtailment on leptin levels in obesity and diabetes mellitus. Obes Facts 2021; 14(2): 214–21. doi: 10.1159/000514095
34. Al Zein M, Zein O, Diab R, Dimachkie L, Sahebkar A, Al-Asmakh M, et al. Intermittent fasting favorably modulates adipokines and potentially attenuates atherosclerosis. Biochem Pharmacol 2023; 218: 115876. doi: 10.1016/j.bcp.2023.115876
35. Faris MAE, Madkour MI, Obaideen AK, Dalah EZ, Hasan HA, Radwan H, et al. Effect of Ramadan diurnal fasting on visceral adiposity and serum adipokines in overweight and obese individuals. Diabetes Res Clin Pract 2019; 153: 166–75. doi: 10.1016/j.diabres.2019.05.023
36. Shalabi H, Alotaibi A, Alqahtani A, Alattas H, Alghamdi Z. Ketogenic diets: Side effects, attitude, and quality of life. Cureus 2021; 13(12): e20390. doi: 10.7759/cureus.20390
37. Shalabi H, Hassan AS, AL-Zahrani FA, Alarbeidi AH, Mesawa M, Rizk H, et al. Intermittent fasting: Benefits, side effects, quality of life, and knowledge of the Saudi population. Cureus 2023; 15(2): e34722. doi: 10.7759/cureus.34722
38. Lopes Neri LDC, Guglielmetti M, Fiorini S, Pasca L, Zanaboni MP, De Giorgis V, et al. Adherence to ketogenic dietary therapies in epilepsy: A systematic review of literature. Nutr Res 2024; 126: 67–87. doi: 10.1016/j.nutres.2024.03.009
39. Jefcoate PW, Robertson MD, Ogden J, Johnston JD. Exploring rates of adherence and barriers to time-restricted eating. Nutrients 2023; 15(10): 2336. doi: 10.3390/nu15102336
40. Rathomi HS, Mavaddat N, Katzenellenbogen JM, Thompson SC. "It just made sense to me!" A qualitative exploration of individual motivation for time-restricted eating. Appetite 2025; 204: 107751. doi: 10.1016/j.appet.2024.107751