

Impact of dietary intake on severity of Multiple Sclerosis

Aleena Jafar¹, Hafiz Ali Bin Asim², Salma Bunyad³, Muneeba Saeed¹, Ghazal Azhar¹, Muhammad Faheem Afzal⁴

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ABSTRACT

Background: Multiple sclerosis is a medical condition and there is no exact cure. Around 2.8 million people suffer from multiple sclerosis worldwide. Several environmental factors also play an important role in the progression of disease.

Objective: The objective of this study is to determine the effect of diet on the severity of multiple sclerosis.

Methods: A cross-sectional study was conducted using nonprobability convenient sampling through a Google form, from November 2021 to April 2022. The sample size for this study was 195 calculated by using Rao soft software. The semi-structured questionnaire includes, a part of the food frequency questionnaire, the Multiple sclerosis quality of life-54 questionnaire, and Multiple sclerosis symptoms. Both males and females above 18 years of age, participants not having other neurological disorders other than MS, not having steroids, or a history of relapse from the past 6 months were included in this study. The institutional review board of PSRD College of Rehabilitation Sciences has granted permission to proceed with an authorization letter (PSRD/CRS/AJ/REC/Letter 26). Data entry, analysis, and interpretation were done using the SPSS software version 26.

Results: The mean age was 36.93 ± 12.24 years. Most of the participants consuming carbohydrates (83.1%), proteins (72.3%), and antioxidants (73.3%) reported that their symptoms were much better from the past year (p value < 0.001). Whereas the participants consuming dairy products reported their symptoms were worse than the last year.

Conclusion: This study concluded that carbohydrates, proteins and antioxidants have positive effects on MS whereas dairy products show negative effects on multiple sclerosis severity.

Keywords: Diet, multiple sclerosis, nutritional status, quality of life

DOI: <http://doi.org/10.33897/fujrs.v5i1.363>

Introduction:

Multiple sclerosis (MS) is an inflammatory condition that causes autoimmune disabling disorders in young adults.(1) Around 2.8 million people suffer from MS worldwide its prevalence has increased since 2013. The prevalence of MS in Pakistan is low but according to recent studies, it may be more common, mostly affected between 20 and 40 years of age with male to female ratio 3:1.(2)

The pathological concept of MS is established as a diffuse “plaque-like sclerosis”. Researchers concluded

that hereditary, infectious, and environmental elements can influence the development of MS.(3) MS risk factors include low serum vitamin D levels, Epstein-Barr virus history, smoking, and obesity, particularly in infancy changing one’s gut microbiota, and being exposed to industrial pollutants.(4,5)

Individuals with MS might have a wide extend of symptoms depending on the area and degree of their central nervous system (CNS) injuries. Injuries within the cerebrum, brain stem, and spinal cord are more likely to deliver issues with the physical working of the limbs.(6) About 50% of individuals with MS, Optic neuritis is the very first symptom they encounter.(7) Elevated body temperatures can impair both physical and cognitive skills, having a significant influence on overall patient safety as well as the capacity of people with MS to complete everyday tasks, even in moderate cases.(8)

Up to 50% of persons with multiple sclerosis (MS) experience depressive problems. Prevalence are typically two to three times greater than those for the general population.(9) Symptomatic therapies, disease-

Affiliations: ¹PSRD College of Rehabilitation Sciences, Lahore, Pakistan. ²Foundation University, Islamabad, Pakistan. ³PSRD Hospital, Lahore, Pakistan. ⁴Australian Health Professional Aged Care, Tumut, New South Wales, Australia.

Correspondence: Aleena Jafar

Email: aleenajafar3@gmail.com

Received: July 26th, 2023; **Revision:** May 29th, 2024

Acceptance: December 19th, 2024

How to Cite: Jafar A, Asim HAB, Bunyad S, Saeed M, Azhar G, Afzal MF. Impact of Dietary Intake on Severity of Multiple Sclerosis. Foundation University Journal of Rehabilitation Sciences. 2025 Jan;5(1):3-9.

modifying therapies, and therapy of exacerbations are the three main types of MS treatment. Because more Disease Modifying Therapies DMTs are being developed, managing MS is getting more difficult.(10) Medications are provided to help patients work better during an MS episode, prevent new MS attacks, and improve signs and symptoms. These drugs are only moderately effective, have adverse effects, and are occasionally poorly tolerated.(11)

Scientific data suggests that dietary variables might increase or relieve MS symptoms, through several pathways i.e., metabolic, inflammatory, etc. Dietary solutions that are simple and beneficial may help alter or reduce the progression of the disease, treat relapses, manage symptoms, improve function and safety, and promote mental health.(3) A study was carried out to see if there was a link between eating fruits and vegetables and having Multiple Sclerosis. There was an inverse relationship between overall fruit and vegies consumption and the risk of Multiple Sclerosis.(12) Associations between food intake habits and health in patients with MS were the subject of a study. People with healthier total diet scores and higher fiber, fruit, and vegetable scores were related to improved health outcomes.(13)

A systematic review concluded that alternative therapy such as homeopathy and dietary supplements (vitamin D, melatonin, carnitine) reduced the incidence of MS, relapse, and new brain lesions in patients. While helping to heal brain damage.(14) In 2018 study was performed to assess the relationship between food quality and the severity of symptoms in people with MS. Questionnaire included estimations of fruit, vegetable, legume, sugar, and processed meat intake. Participants with a high-quality diet score have a low degree of disability and depression.(15) Stress, fatty meat, and processed carbohydrates have a negative impact on persons affected with MS, stress, fatty meat, and processed carbohydrates have a negative impact on disease activity.(16) A total of 101 Relapsing remitting MS patients were included in study. The researchers that all of the patients had much lower vitamin D, folate, magnesium, and calcium intake, which was connected to a high level of fatigue in multiple sclerosis patients. (17)

The previous cross-sectional studies on this topic were conducted in some areas of the world about dietary patterns and their associations especially with fatigue, sexual activity, pregnancy, and depression. The tools used in these studies may be influenced by measurement error and reporting bias. So, in our study, we used

MSQOL- 54 which is fairly reliable and suitable for assessing the health-related quality of life of MS patients The objective of this study is to determine the effects of diet on Multiple sclerosis (MS) severity so that in the future people with MS will be able to manage the effects with the help of diet to achieve better health outcome

Methods:

A cross-sectional study was conducted on the population suffering from Multiple Sclerosis. The duration of this study was 6 months from November 2021 to April 2022 The sample size for this study was 195 calculated by using Rao soft Software, after conducting a census based approached at PSRD. The inclusion criteria included both genders, age above 18 years, diagnosed with relapsing remitting multiple sclerosis (RRMS) more than two years ago, and following the diet plan suggested by nutritionist for the past year. The exclusion criteria included participants having other neurological disorders, having history of relapse or steroidal treatment in the past 6 months.

The participants were requested to fill out the questionnaire which contains demographic data, Food Frequency Questionnaire; FFQ is a valid method for gathering dietary data that employs a context-specific food list to estimate the average diet and analyzes the relationship between consumption patterns and health consequences and has a ICC of 0.90.(18) Multiple sclerosis quality of life; MSQOL-54 a multidimensional health-related quality of life scale that includes both generic and MS-specific items in one instrument (ICC 0.962) and MS symptoms and functional assessment after taking permission from Multiple Sclerosis society of Canada.

Data obtained from these questionnaires were analyzed using the Statistical Package for the Social Sciences software version 26.0. Data were presented in the form of frequencies after analysis and fisher's exact test was applied to determine the association between the variables. The institutional board of review of PSRD College of Rehabilitation Sciences has granted permission to proceed with an authorization letter (PSRD/CRS/AJ/REC/Letter 26). The participants were informed about the study's nature and goal, after which they gave their informed consent using consent forms written in either English or Urdu.

Results:

In our online study, 195 participants were recruited, the demographic data obtained from the participants showed that 64 (32.8%) were male and 131 (67.2%) were female. The mean age of the participants was

36.93±12.24 years. When questioned about the most troubling symptom they experienced in the day-to-day life participants reported 3 main symptoms 86.1 (44.2 %) reported fatigue and fatigability, 59.6 (30.6%) reported pain, and 72.9 (37.4%) reported weakness. Having no history of taking steroids in the past 6 months or any other neurological issues except MS. Questioned about the specific food consumption from the past year with the help of semi-structured FFQ including 29 food items. Each food item was assigned to 4 specific food groups, i.e., carbohydrates, proteins, dairy products and anti-oxidants. 83.1% said they consumed carbohydrates and 16.9% didn't. When asked about proteins 27.7% reported they didn't consume proteins and 72.3% did. 65.6% didn't consume dairy products and 34.4% consumed. 26.7% didn't consume antioxidants and 73.3% consumed antioxidants.

When questioned about the different physical activities they did. Out of 162 Participants consuming carbohydrates, 5(3.1%) reported that their vigorous activity was limited a lot, and 98(60.5%) reported limited not at all with a significant p value of <0.001. Out of 33 participants not consuming carbohydrates, 30(90.9%) reported their vigorous activity limited a lot and 1(3.0%) reported limited not at all. Similarly, when asked about moderate activity, out of 162, participants consuming carbohydrates, 7(4.3%) reported their moderate activity limited a lot and 96(57.4%) reported limited not at all. Out of 33 participants not consuming carbohydrates 23(69.7%) reported their moderate activity limited a lot and 3(9.1%) reported limited not at all.

Similarly, out of 141 participants consuming proteins, 6(4.3%) reported their vigorous activity limited a lot and 88(62.4%) reported limited not at all. Out of 54 participants not consuming proteins, 29(53.7%) reported their vigorous activity was limited a lot and 11(20.4%) limited not at all. When we asked about moderate activity, out of 141 participants consuming proteins 6(4.3%) reported their activity limited a lot, and 89(63.1%) reported their activity limited not at all. Out of 54 participants not consuming proteins, 24(44.4%) reported their moderate activities limited a lot and 10(18.5%) reported limited not at all with a p value of <0.001.

On the other hand, out of 67 participants consuming dairy products, 26(38.8%) reported their vigorous activity limited a lot and 14(20.9%) reported limited not at all. Out of 128 participants not consuming dairy products, 9(7.0%) reported their vigorous activity limited a lot and 85(66.4%) reported limited not at all (p

value<0.001). About moderate activity, 67 participants consuming dairy products 20(29.9%) reported that their moderate activity was limited a lot. Participants not consuming dairy products 128, out of which 10(7.8%) reported that their moderate activity limited a lot and 81(63.3%) reported that their activity was limited not at all.

Participants consuming antioxidants were 143, out of which 12(8.4%) reported their vigorous activity limited a lot and 88(61.5%) reported limited not at all (p value <0.001). Participants not consuming antioxidants were 52, out of which 33(44.2%) reported that their vigorous activity limited a lot and 11(21.2%) limited not at all. When we questioned about the moderate activity out of 143 participants consuming antioxidants 13(9.1%) reported their moderate activity limited a lot and 85(59.4%) reported limited not at all. Out of 52 participants not consuming antioxidants, 17(32.7%) reported their moderate activities, limited a lot and 29(43.3%) reported limited a little.

When asked about the body pain during the past 4 weeks, the responses of the participants shown in table 1.

The frequency of intensity of symptoms experienced during the past year is shown in table 2.

Table 3 shows frequency of participants to rate their health as compared to 1 year ago and table 4 depicts frequency of participants to rate their life as a whole.

Discussion:

195 participants were recruited, the demographic data obtained from the participants showed that 64 (32.8%) were male and 131 (67.2%) were female. The mean age of the participants was 36.93±12.24 years. In this study, out of 162(83.1%) consumed carbohydrates, 60.5% participants reported their vigorous daily activities limited not at all. When we asked about the body pain during the last 4 weeks, 72(44.4%) reported very mild, 72(44.4%) and reported that their life is much better than one year ago. About the intensity of symptoms during the past year 97(59.9%) reported their symptoms were getting better. Hadgkiss EJ reported that reduced levels of patient-reported disease activity and impairment were linked to a higher intake of fruits and vegetables.(19) Noor Mohammadi, M. conducted a case-control study to determine the association of the Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet and its components including green leafy vegetables, other vegetables, and beans and odds of Multiple sclerosis. The result of the study concluded that green leafy vegetables can significantly decrease MS chances.(20)

Table 1: Frequency of body pain during past 4 weeks

		None	Very mild	Mild	Moderate	Severe	Very severe	Fischer Exact Test (P-Value)
Carbohydrates	No	0(0.0%)	0(0.0%)	3(9.1%)	5(15.2%)	11(33.3%)	14(42.4%)	105.07 (<0.001)
	Yes	29(17.9%)	72(44.4%)	44(27.2%)	14(8.6%)	1(0.6%)	2(1.2%)	
Proteins	No	4(7.4%)	6(11.1%)	12(22.2%)	10(18.5%)	10(18.5%)	12(22.2%)	55.53 (<0.001)
	Yes	25(17.7%)	66(46.8%)	35(24.8%)	9(6.4%)	2(1.4%)	4(2.8%)	
Dairy Products	No	28(21.9%)	55(43.0%)	31(24.2%)	9(7.0%)	3(2.3%)	2(1.6%)	48.79 (<0.001)
	Yes	1(1.5%)	17(25.4%)	16(23.9%)	10(14.9%)	9(13.4%)	14(20.9%)	
Antioxidants	No	3(5.8%)	12(23.1%)	8(15.4%)	9(17.3%)	9(17.3%)	11(21.2%)	38.55 (<0.001)
	Yes	26(18.2%)	60(42.0%)	39(27.3%)	10(7.0%)	3(2.1%)	5(3.5%)	

Table 2: Frequency of intensity of symptoms experienced during the past year

		Getting worse	Staying the same	Getting better	Fischer Exact Test (P-Value)
Carbohydrates	No	25(75.8%)	5 (15.2%)	3 (9.1%)	82.79 (<0.001)
	Yes	6(3.7%)	59 (36.4%)	97 (59.9%)	
Protein	No	23 (42.6%)	17(31.5%)	14(25.9%)	39.08 (<0.001)
	Yes	8(5.7%)	47(33.3%)	86(61.0%)	
Dairy products	No	10(7.8%)	36(28.1%)	82(64.1%)	29.60 (<0.001)
	Yes	21(31.3%)	28(41.8%)	18(26.9%)	
Antioxidants	No	19(36.5%)	22(42.3%)	11(21.2%)	32.79 (<0.001)
	Yes	12(8.4%)	42(29.4%)	89(62.2%)	

Table 3: Frequency of participants to rate their health as compared to 1 year ago

		Much better now than one year ago	Somewhat better now than one year ago	About the same	Somewhat worse now than one year ago	Much worse now than one year ago	Fischer Exact Test (P-Value)
Carbohydrates	No	1(3.0%)	2(6.1%)	6(18.2%)	17(51.5%)	7(21.2%)	78.75 (<0.001)
	Yes	72(44.4%)	53(32.7%)	29(17.9%)	6(3.7%)	2(1.2%)	
Proteins	No	4(7.4%)	12(22.2%)	13(24.1%)	17(31.5%)	8(14.8%)	60.69 (<0.001)
	Yes	69(48.9%)	43(30.5%)	22(15.6%)	6(4.3%)	1(0.7%)	
Dairy Products	No	64(50.0%)	43(33.6%)	14(10.9%)	5(3.9%)	2(1.6%)	56.63 (<0.001)
	Yes	9(13.4%)	12(17.9%)	21(31.3%)	18(26.9%)	7(10.4%)	
Antioxidants	No	6(11.5%)	7(13.5%)	17(32.7%)	16(30.8%)	6(11.5%)	53.63 (<0.001)
	Yes	67(46.9%)	48(33.6%)	18(12.6%)	7(4.9%)	3(2.1%)	

Table 4: Frequency of participants to rate their life as a whole.

		Terrible	Unhappy	Mostly dissatisfied	Mixed-about equally	Satisfied and dissatisfied	Mostly satisfied	Pleased	Delighted	Fischer Exact Test (P-Value)
Carbohydrates	No	6(18.2%)	17(51.5%)	7(21.2%)	2(6.1%)	1(3.0%)	0(0.0%)	0(0.0%)	(0.0%)	123.46 (<0.001)
	Yes	0(0.0%)	0(0.0%)	6(3.7%)	22(13.6%)	14(8.6%)	62(38.3%)	49(30.2%)	9(5.6%)	
Proteins	No	6(11.1%)	14(25.9%)	12(22.2%)	9(16.7%)	5(9.3%)	6(11.1%)	1(1.9%)	1(1.9%)	94.57 (<0.001)
	Yes	0(0.0%)	3(2.1%)	1(0.7%)	15(10.6%)	10(7.1%)	56(39.7%)	48(34.0%)	8(5.7%)	
Dairy Products	No	0(0.0%)	3(2.3%)	5(3.9%)	8(6.3%)	6(4.7%)	51(39.8%)	47(36.7%)	8(6.3%)	78.22 (<0.001)
	Yes	6(9.0%)	14(20.9%)	8(11.9%)	16(23.9%)	9(13.4%)	11(16.4%)	2(3.0%)	1(1.5%)	
Antioxidants	No	4(7.7%)	13(25.0%)	11(21.2%)	8(15.4%)	3(5.8%)	11(21.2%)	2(3.8%)	0(0.0%)	68.26 (<0.001)
	Yes	2(1.4%)	4(2.8%)	2(1.4%)	16(11.2%)	12(8.4%)	51(35.7%)	47(32.9%)	9(6.3%)	

Out of 141(72.3%) consumed proteins, 62.4% reported their vigorous activities limited not at all and 63.1% reported their moderate activity limited not at all. Regarding the body pain during the last 4 weeks, 66(46.8%) reported very mild, 69(48.9%) reported that their life is much better than one year ago. In previous study researchers investigated whether there was a link between dietary intake and fatigue in people with multiple sclerosis. In 2016 a study was conducted. This study aimed to see if there was a link between total saturated monounsaturated fatty acid polyunsaturated fatty acid and Omega 3 and 6 and the chance of getting a first clinical diagnosis of central nervous system (CNS) demyelination. Higher consumption of Omega 3 polyunsaturated fatty acids, especially those sourced from fish oil rather than plants, was linked to a lower risk of first clinical diagnosis in 267 cases and 517 controls with dietary data.(21) A systematic search was conducted in 2022 to study the effect of dietary fish intake and the risk of multiple sclerosis, it was concluded that MS risk may be decreased by eating at least 0.5 servings of fish per week during adolescence and later.(22) In 2023, systematic review was conducted to study the effect of meat consumption on MS, and it was concluded that non-processed meat and white meat have protective effects on MS.(23)

Out of 143(73.3%) consumed antioxidants, 61.5% reported their vigorous activities limited not at all and 89(62.2%) reported their symptoms were getting better. Out of the total participants 51(35.7%) consuming antioxidants reported their life satisfied. Research was conducted to study the relationship of curcumin and the multiple sclerosis. Turmeric's yellow color comes from the curcumin component. Curcumin prevents the disruption of BBB permeability by inhibiting pro inflammatory cytokines and chemokines. It may play a role in the treatment of MS due to its anti-inflammatory

properties.(24,25) The study was conducted in 2010 and 2019, the antioxidant and flavonoid content of dark chocolate with 70–85 percent cocoa reported that using flavonoids to treat MS-related fatigue could be fairly effective, affordable, and safe.(26,27) Bagur et did a systematic review to study the effects of food on MS. The study concluded that the incidence of MS decreases with alternative therapies and dietary supplements i.e. vitamin D, melatonin, and carnitine. They play an integral role in the healing in 2022previous brain lesions.(14)

In contrast to this out of 128(65.6%) not consuming dairy products, 66.4% reported their vigorous activities limited not at all. When we asked about the body pain during the last 4 weeks, 55(43.0%) reported very mild, 64(50.0%) and reported that their life is much better than one year ago, 82(64.1%) reported their symptoms were getting better during the past year. Previous researchers concluded that proteins from the milk fat globule membrane of cow's milk have been involved. Butyrophilin protein, which is structurally identical to myelin oligodendrocyte glycoprotein (MOG) and generates antibody cross-reactivity and promotes central nervous system (CNS) inflammation in an animal model. These findings reveal a strong link between cow's milk intake and MS prevalence. (28) The limitations of this study include sample size was calculated as 207 but only 192 participants took part in this study which can affect the result of this study. Non-probability technique was used which can affects the generalizability of the study. Moreover, this study doesn't correlate the occupational factor of the participants with disease severity.

Conclusion:

The study concluded that the some dietary items showed impact on the symptoms severity.

Carbohydrates, proteins and antioxidants play an important role to reduce the risk and severity of the MS, on the other hand, dairy products have negative effects on the disease symptoms. Based on the current findings, a protective dietary pattern may be able to manage the severity of Multiple Sclerosis.

Disclaimer: None to declare.

Conflict of Interest: One of the co-authors of this manuscript is also a member of the Institutional Review Board. He was not part of the ethical review process.

Source of funding: None to declare.

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Authors Contribution:

Jafar A: Conception, design, data collection and final approval

Asim HAB: Data analysis, data interpretation

Bunyad S: Drafting of article, critical review of article, final approval

Saeed M: Conception, design

Azhar G: Acquisition of data, manuscript writing

Afzal MF: Drafting of article, critical review of article, final approval

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