



Research Paper

The Role of Sensory Processing Sensitivity and Self-management on Quality of Life in Multiple Sclerosis



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Citation Bakhshayesh Eghbali B, Hosseini-Nejad M, Saadat S, Babaee M, Eyvani K, Kohandel K, et al. The Role of Sensory Processing Sensitivity and Self-management on Quality of Life in Multiple Sclerosis. *Caspian J Neurol Sci*. 2025; 11(1):67-76. <https://doi.org/10.32598/CJNS.11.40.544.1>

Running Title Sensory Processing, Self-management, and Quality of Life in MS

doi <https://doi.org/10.32598/CJNS.11.40.544.1>



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Article info:

Received: 25 Feb 2024

First Revision: 18 May 2024

Accepted: 26 May 2024

Published: 01 Jan 2025

ABSTRACT

Background: Multiple sclerosis (MS) symptoms lead to functional impairments that predict limitations, unemployment and withdrawal from social or leisure activities and affect the health-related quality of life (HRQOL). Sensory processing sensitivity (SPS) and self-management are important factors affecting HRQOL in people with MS.

Objectives: We decided to determine the role of SPS and self-management in predicting HRQOL in MS patients.

Materials & Methods: This cross-sectional-analytical study was conducted on 320 relapsing-remitting MS patients registered in the nationwide MS registry of Iran (NMSRI), Guilan Province, from March 2020 to March 2021. The SPS questionnaire (SPSQ), MS self-management scale-revised (MSSM-R) and 36-item short-form survey (SF-36) were used to collect data.

Results: The findings showed that quality of life in people with MS has a positive significant relationship with SPS ($r=0.14$) and self-management ($r=0.22$) ($P<0.05$). The results of the multiple regression model also showed that the MSSM-R and SPSQ explained a total of 12% of the variance of the SF-36.

Conclusion: Overall, SPS and self-management are factors affecting the quality of life of MS patients.

Keywords: Sensory processing, Self-management, Health-related quality of life, Multiple sclerosis

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Highlights

- Sensory processing and self-management in multiple sclerosis are important components of active participation in the treatment.
- Multiple sclerosis diminishes health-related quality of life for those affected.
- Sensory processing sensitivity and self-management are important for improving patients' quality of life with multiple sclerosis.

Introduction

Multiple sclerosis (MS) is a central nervous system (CNS) disorder with motor, sensory, cognitive and neuropsychiatric symptoms [1]. It is progressive, chronic and usually starts between the ages of 20 and 40. It is the second leading cause of non-traumatic disability in young people [2]. The prevalence and incidence of MS are rising in developing and developed countries. According to the reports, more than 400000 people in North America and about 2.5 million people worldwide have been affected by this disease. It is estimated that the prevalence of MS in Iran is 15-20 per 100000 population. On average, 5000 newly patients are diagnosed with this disease in Iran every year [2]. Although the exact cause of MS is unknown, some studies suggest that mitochondrial dysfunction, many genes, and environmental factors, such as exposure to ultraviolet B radiation, Epstein-Barr virus (EBV) infection, obesity and smoking, can affect this disease [3-7]. The most common type of this disease is relapsing-remitting MS (85-90%), and the majority of MS treatments are also focused on this type. It is noticeable that a small proportion of patients (10%) have primary progressive MS, and the treatment options for this condition are limited [8, 9]. MS compromises health-related quality of life (HRQOL). It is defined as the functional effect of a disease and its therapeutic outcome on the patient, as perceived by the patient [10].

Depression is known as the most important factor affecting the quality of life of Iranian MS patients [11]. The quality of life emphasizes various aspects of life, such as physical, emotional, cognitive and social [12, 13]. The main goal of treatment for chronic diseases such as MS is to optimize the patient's quality of life [14]. In addition, identifying HRQOL factors can help maximize well-being and quality of life in MS patients. Physical and cognitive impairments, fatigue, comorbidities and emotional symptoms can predict HRQOL in people with

MS [15-17]. Sensory processing is also another factor that may predict HRQOL in MS patients [18]. Sensory processing predicts how to respond to sensory information, including two components: neural threshold and self-regulation [19]. New evidence shows that the processing of sensory information in every person occurs in different ways, meaning that some persons are more sensitive to sensory information than others [20]. Neural threshold refers to the detection value of sensory stimuli, which ranges from hyposensitivity to hypersensitivity [21]. Self-regulation includes active and passive behaviors. Active strategies are responsible for dealing with available sensory information based on a person's neural threshold, while passive strategies are not. For example, people with active hypersensitivity can try to minimize additional sensory input by controlling the environment [22].

Much evidence shows that people with self-regulation (those who have a deep understanding of their own emotions, can manage them effectively, and comprehend the emotions of others) are more successful and efficient in all areas of life. Emotion management includes monitoring flow, evaluating, and changing emotional experiences [20]. On the other hand, learning self-management by patients with chronic diseases is an important component of participation in their treatment [21]. Self-management is an active process of coping with illness through adherence to treatment and medication, participation in medical decisions, self-care, and maintaining social relationships and emotional balance [19]. Another definition of self-management is learning and participating in the skills necessary for an active life and a satisfactory mental state in living with a chronic disease [23].

Among patients with chronic disease, self-management enhances the quality of life, diminishing symptoms and treatment expenses [24]. Additional research suggests that self-management correlates with a broad spectrum of beneficial outcomes in the spheres of health and rehabilitation [25], such as improved self-regulation of

disease symptoms [26], decreased rates of hospitalization [27] and alleviation of pain and anxiety [28]. Implementing self-management strategies that involve a more profound perception of the disease, acquiring relevant knowledge about appropriate dietary and nutritional guidelines and enhancing patient education and skills can significantly contribute to health maintenance and mitigating disease-related side effects [29].

Increasing self-management behaviors seems suitable for people with MS [21, 30-32]. This study investigates the association between HRQOL based on sensory processing sensitivity (SPS) and self-management in MS patients. Conducting this study and its results may provide a suitable solution for performing practical interventions and improving the quality of life in MS patients.

Materials and Methods

This cross-sectional-analytical study was conducted on MS patients registered in the nationwide MS registry of Iran (NMSRI), Guilan Province, from March 2020 to March 2021. The size of the studied population was 320 MS patients with relapsing-remitting MS (RRMS) type. The inclusion criteria were as follows: Patients diagnosed with MS by a neurologist based on revised McDonald criteria 2017 [33], aged between 20 and 55 years, RRMS type and their expanded disability status scale (EDSS) is <7. The exclusion criteria were as follows: Having other autoimmune diseases of the CNS or progressive MS (primary and secondary). Data were collected by three standard questionnaires and a general demographic information checklist. For this purpose, the first step was to upload the questionnaire and informed consent on the Porsline website. Then, a list of all active registered patients in NMSRI, Guilan, was prepared, and the survey link (completion guide, informed consent form, and questionnaire) was sent to them by a simple random method.

Study tools

MS self-management scale-revised (MSSM-R)

This MSSM-R includes 24 items in 5 subscales: Communication with health care providers, treatment adherence/coping with barriers, social/family support, information and knowledge about MS and health maintenance behavior. The scoring method of the questionnaire was based on a 5-point Likert scale (1=completely disagree, 2=somewhat disagree, 3=neither agree nor disagree, 4=somewhat agree, 5=completely agree). The

higher the individual's score, the higher the level of self-management is. The range of changes was between 24 and 120 [34]. This scale was translated into Farsi, and its psychometric properties were calculated by Saadat et al. The results showed that this scale has acceptable face and content validity. The results of confirmatory factor analysis showed that 24 items of the questionnaire have acceptable factor loadings in 5 subscales [35].

36-Item short form survey

The 36-item short-form survey (SF-36) or questionnaire has 36 items that evaluate 8 different areas of health: physical performance, role limitations due to physical health status and emotional problems, energy and vitality, emotional health, social performance, pain, and general health. The lowest score in this questionnaire is zero, and the highest is 100. A lower score means a lower quality of life; The closer the score is to 100, the higher the quality of life. In Montazeri et al.'s study, the Persian version of SF-36 subscales had standard reliability coefficients (0.77 to 0.9). So, it is a standard tool to measure HRQOL with required reliability and validity [36].

SPS questionnaire (SPSQ)

The SPSQ consists of 27 self-report questions that measure psychological reactivity to environmental stimuli. It consists of 3 subscales: Ease of stimulation, aesthetic sensitivity, and low sensory threshold and is answered based on a 7-point Likert scale so that the completely disagree option is given a score of 1 and the agree option is given a score of 7. The range of changes in this tool is between 27 and 189. Higher scores indicate better SPS; the validity and reliability of this questionnaire have been confirmed in an Iranian sample and its Cronbach alpha has been reported to be 0.78 [11].

Statistical analysis

Data analysis was performed in SPSS software, version 24. The data obtained were analyzed by the Independent t-test, one-way analysis of variance, the Pearson correlation coefficient and multiple linear regression. Also, a significance level of 0.05 was considered in this study.

Results

A total of 320 patients participated in this study in 2020. Individual characteristics of patients are given in Table 1.

Table 1. Individual and disease-related characteristics in MS patients

Variables	Status	No. (%) / Mean $\pm$ SD
Demographic findings	Gender	M 89(27.8)
		F 231(72.2)
	Age group (y)	≤ 30 86(26.9)
		31-40 141(44.1)
		≥ 40 93(29.1)
		Mean 36.42 $\pm$ 8.32
	Marital status	Single 75(23.4)
		Married 219(68.4)
		Widowed-divorced 26(8.1)
	Employment status	Employed 51(15.9)
		Unemployed 162(50.6)
		Self employed 89(27.8)
		Others 18(5.6)
	Education status	Illiterate 4(1.2)
		High school 25(7.8)
		Diploma 121(37.8)
		BS 105(32.8)
Habitual status	Smoking	MS and higher 65(20.3)
		Daily 35(10.9)
		used to 29(9.1)
	Exercise	Never 256(80)
		Not 133(41.6)
		Once a week 74(23.1)
		2 or 3/week 113(35.1)
	Perceived stress	No Stress 48(15)
		1 or 2/week 168(52.5)
		A lot 104(32.5)
Disease situation	Duration of disease (y)	<5 123(38.4)
		5-10 110(34.4)
		10-15 569(17.5)
		>15 31(9.7)
		Mean 8.02 $\pm$ 5.45
	Relapse history	Yes 284(88.8)
		No 36(11.2)
	Using DMD	Yes 306(95.6)
		No 14(4.4)
		IFNs 94(30.5)
	Type of DMD	GA 42(13.8)
		DMF 41(13.4)
		Fingolimod 49(16.1)
		RTX 74(24.3)
		Natalizumab 2(0.7)
		Ocrelizumab 4(1.3)
		Teriflunomide 0

Abbreviations: DMD: Disease-modifying drugs; IFNs: Interferons; GA: Glatiramer acetate; DMF: Dimethyl fumarate; RTX: Rituximab.

Table 2. Descriptive findings and correlation coefficients

Variables	SF-36	SPSQ	MSSM-R
SF-36	1	0.14**	0.22**
SPSQ	-	1	0.33**
MSSM-R	-	-	1
Mean±SD	60.74±19.16	127.96±27.24	89.5±16.91
Skewness	-0.35	-0.54	-0.63
Kurtosis	-1.00	-0.88	0.44



Abbreviations: SF-36: 36-item short form survey; SPSQ: Sensory processing sensitivity questionnaire; MSSM-R: Multiple sclerosis self-management scale-revised.

**Correlation is significant at the 0.01 level (2-tailed).

Table 2 reports the central tendency indices of the main research variables, the skewness and kurtosis indices, and the Pearson correlation coefficients between the variables.

In **Table 2**, the results show that the skewness and kurtosis indices are in the range of ± 2 ; accordingly, the data have a normal distribution. Also, the results of the Pearson correlation coefficient test showed that the quality of life in people with MS has a positive significant relationship with SPS ($r=0.14$) and self-management ($r=0.22$, $P<0.05$). **Table 3** compares the scores of individuals on the SPSQ, MSSM-R and SF-36 based on demographic information.

The findings in **Table 3** show that the SF-36 score is significantly different according to gender, age group, marital status, education level, disease duration, and history of recurrence; also, the MSSM-R score was significantly different based on using DMD. Another finding shows that the SPSQ score is significantly different based on gender and employment status ($P<0.05$). The results of the regression model are presented in **Table 4**.

The stepwise multiple regression model results showed that MSSM-R and SPSQ, with beta coefficients of 0.296 and 0.240, respectively, significantly explained 12% of the variance in quality of life in people with MS.

Discussion

This study investigated the relationship between HRQOL and sensory processing and self-management in people with MS. The results showed that the majority of patients were female, married, homemakers, and in

the age group of 31-40 years with a duration of illness less than 5 years and had a history of relapses and disease attacks. The findings showed that the SF-36 score significantly differed according to gender, age group, marital status, education level, disease duration, and history of recurrence. Also, the MSSM-R score was significantly different based on Using DMD. Another finding showed that the SPSQ score significantly differed based on gender and employment status. The results of multivariate regression showed that the quality of life-related to health can be predicted by sensory processing and self-management variables.

The influence of gender on MS has been evidenced across various dimensions of the condition, including a heightened vulnerability in women and more severe disease progression and outcomes in men [37]. In terms of the interplay between gender and age, the findings of this study indicated that 72.2% of the MS patients were female, with 44.1% falling within the age range of 31 to 40 years. Similar to the present study, Magyari and Sorensen reported this disease in women 3 times more than men, and the age of onset of the disease was between 20 and 40 years, although according to the reports, this disease can occur at any age [38]. This report is consistent with the results of other researchers [39-41]. In a way, it refers to the importance of the difference between the hormones of men and women, as well as the greater tendency of women than men to suffer from autoimmune diseases [42].

Numerous studies assessed the employment status of patients with MS [43-46]. In the current study, 50.6% of participants were homemakers and unemployed. In contrast, previous research indicated that 88% of individuals

Table 3. Comparing SPSQ, MSSM-R and SF-36 scores based on demographic information

Demographic Information		No.	SF-36		MSSM-R		SPSQ	
			Mean±SD	P	Mean±SD	P	Mean±SD	P
Gender	M	89	55.61±18.78	0.002	83.89±19.2	0.001	117.75±24.56	<0.001
	F	231	62.71±18.99		91.67±15.44		131.9±27.24	
Age group (y)	≤30	86	66.03±17.2	0.003	90.04±14.58	0.863	132.38±22.65	0.205
	31-40	141	60.52±19.38		89.77±17.14		126.75±28.15	
	≥41	93	56.17±19.54		88.61 ±18.61		125.7±29.44	
Marital status	Single	75	65.29±18.68	0.001	89.12 ±15.79	0.694	128.56±23.89	0.066
	Married	219	60.67±18.67		89.7±17.46		126.39±27.64	
	Widowed-divorced	26	48.17±19.67		89.0 ±15.79		139.5±30.89	
Employment status	Employed	51	67.98±16.05	<0.001	83.31 ±20.05	0.684	120.96±33.87	0.032
	Unemployed	162	55.92±18.84		89.09±16.23		132.02±27.11	
	Self Emp.	89	66.7±18.76		91.12±16.88		126.11±22.8	
	Others	18	54.05±18.37		91.44 ±13.35		120.44±22.65	
Education status	Illiterate	4	36.94±22.45	<0.001	72.25 ±1.5	0.133	129.0±18.47	0.255
	High school	25	47.62±20.49		87.68±19.94		130.88±37.05	
	Diploma	121	58.22±17.61		89.6±15.8		131.92±27.41	
	BS	105	59.23±18.8		68.63±18.62		125.01±26.99	
	MS and upper	65	74.36±13.69		92.5±14.62		124.16±22.64	
Duration of Disease (y)	<5	123	64.77±16.74	0.01	88.3±17.18	0.338	129.96±27.44	0.064
	5-10	110	60.85±18.52		91.54±17.04		128.34±27.05	
	10-15	56	55.75±23.3		88.96±17.63		129.51±27.23	
	>15	31	53.33±18.82		88.06±13.78		115.87±25.2	
Using DMD	Yes	306	60.83±19.18	0.607	90.49±16.28	<0.001	128.27±9.06	0.738
	No	14	58.73±19.32		68.0±16.53		125.21±31.81	
Relapse history	Yes	284	59.76±19.46	0.019	89.62±17.15	0.476	128.25±26.81	0.596
	No	36	68.43±14.71		88.61±14.98		125.69±30.74	

Table 4. Multivariate regression predicting health-related quality of life in patients with MS

Predictor Variables	B	SE	Beta	T	P
MSSM-R	0.335	0.064	0.296	5.233	<0.001
SPSQ	0.169	0.040	0.240	4.249	<0.001



SPSQ: Sensory processing sensitivity questionnaire; MSSM-R: Multiple sclerosis self-management scale-revised.

with MS had maintained a stable and or permanent job at some point in their lives, with a breakdown of 95% for men and 85% for women. Consistent with findings from other studies [44, 47], our research revealed that most unemployed patients were women with fewer years of education. This finding suggests that the lower employment rates among women at the onset of the disease may not solely be attributed to the clinical manifestations of MS but also to the greater challenges women face, regardless of age, in securing regular paid employment compared to men. Conversely, some studies have indicated a heightened risk of unemployment among men with MS [48, 49]. Other research has not found a significant correlation between gender and occupational status [43, 49].

The analytical findings of this study show that SPS and self-management are two important factors in predicting the quality of life of people with MS. This finding is consistent with previous studies [50, 51]. The importance of SPS and self-management in improving the quality of life of MS patients has been emphasized in previous studies. In explanation, it can be said that SPS and effective self-management strategies can significantly improve the quality of life of MS patients. People with strong sensory sensitivity attend more to sensory stimuli, which can help them recognize and respond more effectively to their body's needs. This increased awareness allows for better management of MS-related symptoms, such as fatigue and pain [50]. Self-management also allows people to adjust their care routines according to their unique sensory processing patterns. This activity can include adjusting their environment to minimize overstimulation or fatigue improving daily functioning and overall quality of life [51]. Through self-management, people can develop effective coping strategies aligned with their sensory profiles. For example, those sensitive to sensory stimuli may benefit from creating quieter, more controlled environments to reduce sensory overload [51]. In summary, SPS and self-management strategies play an important role in improving the quality of life of people with MS. By cultivating greater awareness of their sensory experiences and implementing self-

management techniques; individuals can better cope with the challenges posed by their condition, leading to improved emotional well-being and daily functioning.

One of the limitations of this study was the lack of a control group to compare with patients with MS to examine the variables. Another limitation was the online completion of information, which was used due to the coincidence of sampling with the COVID-19 pandemic to prevent patients from getting infected instead of being present on site. The number of questionnaires and the multiplicity of questions that people could answer could be a deterrent factor in providing correct answers. Before the collection, the necessary explanations were given to the eligible patients regarding the importance of the patients' correct answers in expressing the results. Although the importance of data collection in person and through interviews cannot be ignored, the online method was accepted during sampling.

Conclusion

In summary, SPS and self-management are important factors in improving the quality of life of people with MS. Accordingly, empowerment interventions to improve psychological status and self-management of the quality of life of these people are recommended.

Ethical Considerations

Compliance with ethical guidelines

The research was approved by the Research Ethics Committee of the [Guilan University of Medical Sciences](#) (Code: IR.GUMS.REC.1399.542).

Funding

This article was extracted from Neurology specialty thesis of Masomeh Babae, approved by [Guilan University of Medical Sciences](#) (Registration No.: 1244) and financially supported by [Guilan University of Medical Sciences](#) (Grant No.: 2756).

Authors contributions

Supervision: Mozaffar Hosseini-nezhad, Alia Saberi, and Sajjad Saadat; Funding administration and methodology: Babak Bakhshayesh Eghbali and Sajjad Saadat; Data analysis: Sajjad Saadat; Investigation: Masomeh Babaee, Kimia Eyvani and Kosar Kohandel; Conceptualization, writing the original draft, review and editing: All authors.

Conflict of interest

The authors declared no conflict of interest.

Acknowledgements

The authors appreciate all the participants who helped us complete the questionnaires and also thank the Clinical Research Development Unit of **Poursina Hospital, Guilan University of Medical Sciences**.

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