Original Article

The Effect of Pain, Fatigue, and Sleep Quality on Activities of Daily Living in Patients with Multiple Sclerosis by Gender: A Descriptive Study from Turkey

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ABSTRACT

Background: Multiple sclerosis (MS) is a chronic neurological disease that progresses with crisis and remission and causes significant psychosocial problems. Fatigue and sleep disorders are reported to be the most frequent problems that could change by gender and potentially affect daily living activities. **Aim:** This study aimed to examine the effects of pain, fatigue, and sleep quality on the activities of daily living in patients with multiple sclerosis by gender. **Methods:** This cross-sectional study involved 188 patients with MS. G*Power 3.4.9 was used in the study sample estimation, and it was found that at least 111 women and 45 men individuals should be reached with 0.5 (medium) effect size, 80% power, 5% type I error, and 2.5 allocation ratio. Considering 10% data loss, the study was completed with 188 multiple sclerosis patients, 134 women and 54 men. **Results:** PwMS's pain, fatigue, sleep, and daily living activities were compared according to gender; it was found that the difference in the mean scores of women's PSQI subdimension "habitual sleep efficiency" was statistically significantly higher than that of men's ($P < 0.05$). A negative correlation was found between FIS scores and NEADL total scores and subdimension scores in men and women with MS ($P < 0.05$). In women with MS, the degree of fatigue being "important" (9.184 units) and "very important" (7.893 units) reduces daily living activities. In men with MS, "poor sleep quality" reduces activities of daily living (11.559 units). **Conclusion:** According to gender, women's DLA was negatively affected by fatigue, while men's DLA was negatively affected by poor sleep quality. Therefore, increased sleep disorders in men and fatigue in women may cause a decrease in daily life activities.

Keywords: *Daily living activities, fatigue, gender, multiple sclerosis, pain, sleep quality*

Introduction

Multiple sclerosis (MS) is a chronic neurological disease that affects the function of the central nervous system, mainly in the younger population, leading to physical disabilities.[1] The prevalence of MS is increasing, and it is more common in women than in men.[2] A prevalence study conducted in Turkey determined that women with MS were 2.5 times likelier than men.[3] It is estimated that approximately 2.5 million individuals worldwide, mostly in America and Europe, have been diagnosed with MS.[4] The prevalence of MS varies according to genetic and regional characteristics, and Turkey is in the 20–60/100.000 group in the World MS Atlas.[5] In recent studies, pain, fatigue, sleep disturbances and changes, and a decrease in physical activity levels have been reported as the most common

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problems in patients with multiple sclerosis (PwMS).[6,7] Although the mechanism of pain associated with MS is still not convincingly explained, pain prevalence is 25–90%, and it is a common symptom affecting quality of life.[8] A longitudinal study of chronic pain in patients with multiple sclerosis (PwMS) revealed a significant deterioration in quality of life at the 10-year follow-up.[9]

Fatigue is one of the most common symptoms in MS patients, with rates ranging from 58.1% to 81%.[10] The relevant literature emphasizes that fatigue is associated with impaired quality of life, even beyond pain and motor disability, independent of depression or neurological status.[11-13]

MS also leads to irregular sleep or sleep problems that affect the overall wellbeing and quality of life.[14] Studies have emphasized that high physical activity levels are essential for better sleep quality in PwMS and that these activities improve and heal subjective and objective sleep.[6,15]

In PwMS, impairment and limitations in activities of daily living (ADL) that occur due to the negative effects of pain, sleep problems, and fatigue on physical activity are the main problems,[16] and in 69.4% of the affected individuals, they are unable to perform activities of daily living causes limitations.[17] The fact that MS symptoms generally increase within 10 years and cause a regression in ADL requires evaluating the performances of the patients and revealing the negative effects of MS.[18] The incidence, prevalence, frequency, and relapses of MS have increased recently, especially among women.[19] On the other hand, it has been reported that the good prognosis of the disease in MS is more associated with women gender and the progression is worse in men than in women.[20]

Although sleep, pain, physical activity, and fatigue symptoms in PwMS have been investigated separately in the literature, no study has been found in which the effects of all of them on ADL according to gender were examined. It was thought that knowing the effects of pain, fatigue, and sleep on DLA by gender in PwMS could provide implications for care, education, follow-up, and treatment to improve daily activities.

Research questions

1. Do pain, sleep, and fatigue affect daily living activities in multiple sclerosis patients by gender?
2. What are the factors that affect the daily living activities of multiple sclerosis patients by gender?

Materials and Methods

This study was cross-sectional and consisted of individuals diagnosed with MS in Turkey. Based on the literature, MS is 2.5 times more common in women than in men in Turkey.[3] A power analysis was performed (GPower 3.1.9.7) to determine the sample size; at least 111 women and 45 men were found suitable for inclusion in the study, with 80% power, 5% type I error, and a 2.5 allocation ratio according to a 0.5 (medium level) effect size. After adding 10% loss percentages, the minimum required number was 121 for women and 50 for men. The study was completed with 134 women and 54 men.

Data analysis

The data were evaluated using the IBM SPSS 21 program. Normality control of continuous variables was conducted using the Shapiro–Wilk test. Pearson's and Spearman's rho correlation coefficients were calculated to examine the linear relationship between continuous variables. In univariate analyses, multiple linear regression models were created for the influential variables of pain, fatigue, sleep, and daily living activities.

Ethical considerations

The study was approved by Çukurova University Faculty of Medicine Ethics Committee (No = 24/08.04.2022/121). Authorization was obtained from the developers of the scales. Participation was voluntary, and informed consent of the participants was obtained from all participants. This study was carried out according to the principles of the Declaration of Helsinki (World Medical Association, 2018).

Data collection

The study was conducted between August 1 and October 1, 2022. The data were collected with random and snowball sampling methods online (Google Docs) using a personal information form – the Pittsburgh sleep quality index (PSQI), numerical rating scale (NRS), fatigue impact scale (FIS), and Nottingham extended activities of daily living index (NEADL). The inclusion criteria were (1) being 18 years of age, (2) being diagnosed with multiple sclerosis, and (3) volunteering for the study. In addition, members of national MS associations and societies were contacted to create an extensive distribution network. Data collection forms prepared with the Google Docs program were sent via online communication channels (WhatsApp, Facebook, e-mail, etc.). The sample population was obtained from the whole of Turkey. MS association members in each region were contacted through social communication channels. When delivering the online forms to individuals with PwMS, they were requested to share them on a voluntary basis. They were asked to fill out the forms and share them with the PwMS around them. It took each participant 15 minutes to fill out the forms.

The data obtained during the 3-month data collection period were analyzed.

Data collection tools

Personal information form

Personal information was collected based on a literature review conducted by the researchers. The form consisted of 13 items on sociodemographic and personal characteristics (age, gender, marital status, education, etc.).[12,20]

Pittsburgh sleep quality index (PSQI)

The PSQI was developed by Buysse *et al*. (1989).[21] The Turkish population's reliability and validity study of the scale was carried out by Ağargün *et al*. in 1996.[22] The scale consists of seven components. The components of subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction measure seven subcomponents of sleep quality. Each item in the scale was scored between 0 and 3. The range of the overall PSQI scores varied between 0 and 21. Sleep quality was evaluated as poor in those with an overall score of more than 5 and fine in those with an overall score of 5 or lower. The scale had a Cronbach's alpha of 0.83, which was 0.76 in this study.

Numerical rating scale (NRS)

To measure pain intensity, the patient was asked to choose the number that best reflected the pain intensity from the numbers between 0 and 10 (0 = no pain, 10 = unbearable pain). Pain scores are "0 = no pain," "1–3 = mild pain," "4–6 = moderate pain," and "7–10 = severe pain".[23]

Fatigue impact scale (FIS)

The FIS was developed by Fisk JD *et al*., 1994.[24] The Turkish validity and reliability study of the scale was carried out by Armutlu *et al*. in 2007.[25] The FIS is a multidimensional scale that comprises 40 questions measuring the physical (10 questions), cognitive (10 questions), and social (20 questions) effects of fatigue. Every question is scored between 0 and 4, and the total score is between 0 and 160. The score is proportional to the impact of fatigue. It is the most commonly used scale to evaluate fatigue in MS and the ideal scale to evaluate the effect of fatigue on daily life.[26] The scale had a Cronbach's alpha of 0.98, which was 0.97 in this study.

Nottingham extended activities of daily living index (NEADL)

The NEADL was developed by Turner-Stokes in 1997.[27] It is also one of the most popular extended activities of daily living scales in rehabilitation centers in the UK.[27] A validity and reliability study was conducted by Sahin *et al*. in 2008.[28] The NEADL was used as a criterion measure to assess the activities of daily living. The scale consists of 22 questions. The participants answered questions by choosing from the following options – "on your own" (3 points), "on your own with difficulty" (2 points), "with help" (1 point), and "not at all" (0 points). The highest score was 66. Low points indicate an increased limitation in the activities of daily living. The scale had a Cronbach's alpha of 0.97, which was 0.94 in this study.

Results

The study was completed with 188 participants, with a mean age of 40.97 ± 8.64 and 41.26 ± 8.07 for women

Table 1: Comparison of NRS, FIS, PSQI, and NEADL scale scores of individuals diagnosed with MS by gender

	Women		Men		Total		*P**
	Medyan [IQR]	Min-Max	Medyan [IQR]	Min-Max	Medyan [IQR]	Min-Max	
Total NRS	6 [3-7]	0-10	5 [2-8]	0-10	5 [3-7.75]	0-10	0.274
Total FIS	65.5 [39-101.25]	0-160	78 [33.5-125.25]	2-156	71 [39-104.5]	0-160	0.302
1- Subjective sleep quality	1 [1-2]	0-3	1 [1-2]	0-3	1 [1-2]	0-3	0.809
2- Sleep latency	2 [1-2]	0-3	2 [1-3]	0-3	2 [1-2]	0-3	0.918
3- Sleep duration	1 [0-2]	0-3	1 [0-2]	0-3	1 [0-2]	0-3	0.858
4- Habitual sleep efficiency	0 [0-2]	0-3	0 [0-1]	0-3	0 [0-1]	0-3	0.020
5- Sleep disturbances	2 [1-2]	0-3	2 [1-2]	1-3	2 [1-2]	0-3	0.068
6- Use of sleeping medication	0 [0-0]	0-3	0 [0-0]	0-3	0 [0-0]	0-3	0.992
7- Daytime dysfunction	1 [0.75-2]	0-3	1 [1-2]	0-3	1 [1-2]	0-3	0.978
Total PSQI	8 [5-12]	1-21	7 [4-11]	1-17	8 [5-11.75]	1-21	0.303
1- Mobility	16 [11-18]	0-18	15.5 [10-18]	0-18	16 [10.25-18]	0-18	0.783
2- Kitchen activities	15 [13-15]	1-15	14.5 [8-15]	0-15	15 [12-15]	0-15	0.091
3- Domestic tasks	13 [9-15]	1-15	12.5 [6-15]	0-15	13 [8.25-15]	0-15	0.663
4- Leisure time activities	15 [12-18]	3-18	15 [11-18]	3-18	15 [12-18]	3-18	0.568
Total NEADL	56 [44.75-63.25]	15-66	56.5 [40.5-66]	6-66	56 [43-64]	6-66	0.803

**P*, Mann Whitney *U* test; SD, Standart deviation; Min, Minimum; Max, Maximum. IQR: Interquartile range

Table 2: The relationship between NRS, FIS, PSQI, and NEADL in women and men with MS

Gender	Scales and subscales	Correlation and statistical significance	Women														
			Total NRS	Total FIS	Subjective sleep quality	Sleep latency	Sleep duration	Habitual sleep efficiency	Sleep disturbances	Use of sleeping medication	Daytime dysfunction	Total PSQI	Mobility	Kitchen activities	Domestic tasks	Leisure time activities	Total NEADL
Men	Total NRS	*r*	1.000	0.602**	0.444**	0.215*	0.241**	0.179*	0.566**	0.363**	0.650**	0.564**	-0.125	-0.159	-0.274**	-0.255**	-0.264**
		P		0.000	0.000	0.013	0.005	0.038	0.000	0.000	0.000	0.000	0.150	0.067	0.001	0.003	0.002
	Total FIS	*r*	0.449**	1.000	0.487**	0433**	0.352**	0.395**	0.674**	0.141	0.514**	0.616**	-0.306**	-0.303**	-0.522**	-0.501**	-0.477**
		P	0.001		0.000	0.001	0.009	0.003	0.000	0.310	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Subjective sleep quality	*r*	0.190	0.472**	1.000	0.442**	0.479**	0.381**	0.591**	0.271**	0.503**	0.789**	-0.074	-0.128	-0.220*	-0.259**	-0.164
		P	0.169	0.000		0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.398	0.141	0.011	0.002	0.059
	Sleep latency	*r*	0.345*	0.273**	0.563**	1.000	0.243**	0.383**	0.422**	0.182*	0.251**	0.615**	-0.110	-0.034	-0.165	-0.138	-0.130
		P	0.011	0.001	0.000		0.005	0.000	0.000	0.035	0.003	0.000	0.204	0.700	0.057	0.113	0.135
	Sleep duration	*r*	0.212	0.292**	0.654**	0.438**	1.000	0.619**	0.365**	0.183*	0.245**	0.709**	-0.258**	-0.226**	-0.213*	-0.200*	-0.222**
		P	0.124	0.001	0.000	0.001		0.000	0.000	0.034	0.004	0.000	0.003	0.009	0.014	0.021	0.010
	Habitual sleep efficiency	*r*	0.216	0.243**	0.447**	0.402**	0.494**	1.000	0.302**	0.065	0.128	0.660**	-0.261**	-0.189*	-0.210*	-0.209*	-0.227**
		P	0.117	0.005	0.001	0.003	0.000		0.000	0.454	0.142	0.000	0.002	0.029	0.015	0.015	0.008
	Sleep disturbances	*r*	0.507**	0.521**	0.496**	0.550**	0.324*	0.424**	1.000	0.258**	0.520**	0.698**	-0.252**	-0.182*	-0.290**	-0.218*	-0.268**
		P	0.000	0.000	0.000	0.000	0.017	0.001		0.003	0.000	0.000	0.003	0.035	0.001	0.011	0.002
	Use of sleeping medication	*r*	0.066	0.318**	0.266	0.498**	0.217	0.220	0.159	1.000	0.280**	0.447**	-0.122	-0.199*	-0.227**	-0.255**	-0.240**
		P	0.635	0.000	0.052	0.000	0.115	0.109	0.250		0.001	0.000	0.162	0.021	0.008	0.003	0.005
	Daytime dysfunction	*r*	0.308*	0.660**	0.504**	0.382**	0.461**	0.263	0.582**	0.074	1.000	0.622**	0-.129	-0.140	-0.294**	-0.239**	-0.232**
		P	0.024	0.000	0.000	0.004	0.000	0.055	0.000	0.595		0.000	0.138	0.106	0.001	0.005	0.007
	Total PSQI	*r*	0.399**	0.582**	0.798**	0.792**	0.733**	0.633**	0.738**	0.436**	0.702**	1.000	-0.247**	-0.237**	-0.328**	-0.317**	-0.303**
		P	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000		0.004	0.006	0.000	0.000	0.000
	Mobility	*r*	-0.251	0-.580**	-0.216	-0.205	-0.081	-0.109	-0.372**	-0.039	-0.205	-0.260	1.000	0.746**	0.689**	0.556**	0.874**
		P	0.067	0.000	0.116	0.137	0.560	0.432	0.006	0.780	0.137	0.057		0.000	0.000	0.000	0.000
	Kitchen activities	*r*	-0.180	-0.429**	-0.223	-0.225	-0.026	-0.076	-0.309*	-0.027	-0.166	-0.235	0.855**	1.000	0.697**	0.583**	0.805**
		P	0.194	0.001	0.106	0.103	0.850	0.583	0.023	0.847	0.230	0.087	0.000		0.000	0.000	0.000
	Domestic tasks	*r*	-0.253	-0.538**	-0.272*	-0.297*	-0.150	-0.203	-0.447**	-0.147	-0.318*	-0.368**	0.834**	0.810**	1.000	0.637**	0.872**
		P	0.064	0.000	0.047	0.029	0.280	0.141	0.001	0.290	0.019	0.006	0.000	0.000		0.000	0.000
	Leisure time activities	*r*	-0.186	-0.480**	-0.137	-0.217	-0.065	-0.242	-0.438**	0.026	-0.234	-0.279*	0.750**	0.731**	0.843**	1.000	0.816**
		P	0.178	0.000	0.322	0.115	0.640	0.077	0.001	0.850	0.088	0.041	0.000	0.000	0.000		0.000
	Total NEADL	*r*	-0.253	-0.570**	-0.269*	-0.301*	-0.105	-0.197	-0.479**	-0.060	-0.305*	-0.362**	0.909**	0.877**	0.937**	0.917**	1.000
		P	0.065	0.000	0.049	0.027	0.451	0.153	0.000	0.668	0.025	0.007	0.000	0.000	0.000	0.000	

****r**, Spearman correlation coefficient

Table 3: Variables affecting NEADL according to gender of individuals with MS

Dependent variable	Independent variable	Unstandardized Coefficients		Standardized Coefficients	95,0% Confidence Interval for *B*		*t*	*P**
		B	Std. Error	Beta	Lower Bound	Upper Bound		
Women	(Constant)	56.536	6.590		43.493	69.579	8.579	<0.001
Dependent variable:	Age	-0.238	0.131	-0.145	-0.498	0.021	-1.817	0.072
NEADL	Regular working life	8.550	2.640	0.319	3.325	13.775	3.238	0.002
R^2=0.381	Primary school	-8.326	3.402	-0.198	-15.059	-1.593	-2.447	0.016
F=9.622	Unemployed	6.150	2.758	0.219	0.692	11.608	2.230	0.028
P<0.001	Having no support for housework	4.853	1.924	0.182	1.044	8.661	2.522	0.013
	Fatigue impact (none)	5.565	2.544	0.164	0.530	10.599	2.187	0.031
	Fatigue impact (important)	-9.184	2.655	-0.261	-14.438	-3.930	-3.459	0.001
	Fatigue impact (very important)	-7.893	3.377	-0.182	-14.578	-1.209	-2.337	0.021
Men	(Constant)	45.289	4.845		35.536	55.042	9.347	<0.001
Dependent variable:	Regular working life	23.154	4.132	0.573	14.837	31.471	5.604	<0.001
NEADL	High school	-15.626	4.964	-0.315	-25.619	-5.633	-3.148	0.003
R^2=0.624	Associate degree	-8.718	4.679	-0.198	-18.137	0.700	-1.863	0.069
F=10.890	Postgraduated	-14.543	5.620	-0.253	-25.856	-3.230	-2.588	0.013
P<0.001	Unemployed	15.519	6.176	0.253	3.088	27.951	2.513	0.016
	Fatigue (none)	8.293	4.599	0.184	-0.964	17.549	1.803	0.078
	PSQI (poor)	-11.559	4.396	-0.268	-20.407	-2.711	-2.630	0.012

**P*, Multiple Linear Regression; B: Unstandardized coefficients; SE: Standart Error; CI: Confidience interval; *t*: independent sample-*t* test; R^2: Linear regression; *F*: *F* test

Table 4: The regression analysis of pain, PUKI, and fatigue on DLA based on gender

		Unstandardized Coefficients		Standardized Coefficients	95,0% Confidence Interval for B		*t*	*P*
		B	Std. Error	Beta	Lower Bound	Upper Bound		
Women	(Constant)	64.075	2.780		58.576	69.574	23.051	0.000
R^2=0.220	NRS	0.372	0.469	0.080	-0.556	1.299	0.792	0.430
F=12.217	PSQI	1.765	2.860	0.055	-3.894	7.423	0.617	0.538
P<0.001	FIS	-5.385	1.068	-0.505	-7.499	-3.272	-5.041	<0.001
Men	(Constant)	71.832	5.442		60.901	82.763	13.199	0.000
R^2=0.281	NRS	-0.011	0.812	-0.002	-1.643	1.620	-0.014	0.989
F=6.507	PSQI	-8.077	5.829	-0.188	-19.786	3.631	-1.386	0.172
P=0.001	FIS	-5.881	1.924	-0.448	-9.745	-2.018	-3.057	0.004

P: Multiple Linear Regression; B: Unstandardized coefficients; SE: Standart Error; CI: Confidience interval; *t*: independent sample-*t* test; R^2: Linear regression; *F*: *F* test

and 40.26 ± 9.97 years for men. The NRS mean score was 5.18 ± 2.88 in women and 4.56 ± 3.12 in men. The FIS total scores were 70.4 ± 40.81 for women and 78.91 ± 47.21 for men. The PSQI total score averages for women were 8.51 ± 4.46 and 7.81 ± 4.43 for men. On the other hand, the NEADL total mean score in women was 52.75 ± 13.3 and 48.63 ± 19.47 in men. In the study, the rate of unemployed women was higher (33.6%) than that of men, and the rate of employed men (61.1%) was higher than that of women. While 54.4% of women did housework themselves, 92.6% of men did not do housework.

In Table 1, where PwMS's pain, fatigue, sleep, and daily living activities are compared according to gender, it was found that the difference in the mean scores of women's PSQI subdimension "habitual sleep efficiency" was statistically significantly higher than that of men ($P < 0.05$) [Table 1].

A negative correlation was found between FIS scores and NEADL total scores and subdimension scores in men and women with MS ($P < 0.05$) [Table 2].

The variables that may affect the NEADL value and the results of the multiple linear regression analysis performed with the backward elimination method are given in Table 3. While both regular working life (23.154 units) and being unemployed (15.519 units) increase the NEADL score in men, poor sleep quality (11.559 units), high school graduate (15.626 units), and postgraduate degree (14.543 units) decrease the NEADL score. Variables in the model predicted 62.4% of the NEADL score in men ($P < 0.001$) [Table 3].

In women, regular working life (8.550 units), doing housework alone (4.853 units), absence of fatigue (5.565 units), and being unemployed (6.150 units) increase the NEADL score; the degree of fatigue at a "significant" level (9.184 units) and "very important" level (7.893 units) and being a primary school graduate (8.326 units) decrease it. Variables in the model predicted 38.1% of the NEADL score in women ($P < 0.001$) [Table 3].

While fatigue reduces NEADL by 5.385 units in women PwMS, it decreases by 5.881 units in men ($P < 0.001$). Pain, sleep, and fatigue predict 22% of NEADL in women and 28.1% in men [Table 4].

Discussion

This study examined the effects of pain, sleep, and fatigue on ADL in PwMS patients based on gender. This study showed that while moderate and significant fatigue impact levels negatively affected women's daily activities, poor sleep quality negatively affected men. Pain, sleep, and fatigue explain 22% of ADL in women and 28.1% in men.

In the current study, both genders had similar ADL levels. One of these constraints is the difficulties experienced by persons in performing ADL.[16,29] A study conducted with patients who completed the first 10 years of the diagnosis of MS determined that they tended to become mildly dependent on their ADL within the first 10 years.[18,29] Jansa *et al*.[29] evaluated motor skills in PwMS. They determined that gender was important in motor skills and that women showed higher performance in ADL. In contrast, Başak *et al*.[18] (2015) stated that there was no significant relationship between the gender of PwMS and ADL performance. In a study examining the differences in ADL in PwMS according to gender, it was emphasized that women were more active in ADL. However, the fatigue impacts were similar in both men and women. Only women with a long-term MS diagnosis had very important fatigue impacts.[19] This study participant had no limitations or good levels of ADL. The current study's participants were middle-age adults, and the data were collected online. Generally, participation in online studies is expected to potentially involve young or middle-aged adults rather than older people.

The multiple regression model was significant in this study. The variables in the model explained 38.1% of the ADL in women. In the present study, the ADL of women with MS was affected by age, regular working life, primary school graduates, unemployment, housework by themselves, and fatigue impact levels [Table 4]. Additionally, pain, sleep, and fatigue explained 22% of the ADL in women. Fatigue reduced the ADL by 5.385 units in women [Table 4]. The study participants had moderate pain levels, and both genders had similar ($P > 0.05$). It is stated in many existing studies that women experience painlessness,[30] the intensity of pain in PwMS increases with the progression of the disease,[31] increased pain decreases physical activity and condition,[32] an increased level of fatigue causes the pain and sleep difficulties to increase as well, and an increase in fatigue level increases pain.[33] According to current research, it can be said that increased sleep problems in women with MS increase fatigue and therefore cause a decrease in ADL. Previous studies have shown that sleep disturbance in PwMs is between 48% and 67% and is four times higher than in the general chronic patient population,[34-36] stating that women with an MS diagnosis have higher daytime sleepiness.[36] In other studies, sleep problems affected women with MS more than men.[37,38] This result suggests that sex hormones and psychosocial and genetic factors may cause sleep differences between men and women with MS.[38,39] In Turkey, although women traditionally have a regular job, they can be responsible for themselves and all family members, including housework. Therefore, although women may feel pain, sleep problems, or fatigue, they are mostly able to fulfil all their gender-related roles. Maintaining daily caring activities might be a learned habit despite existing pain, sleep problems, and fatigue, or this habit might provide dynamism.

The variables in the model explained 62.4% of the ADL in men. Based on multiple regression analysis, fatigue impact level and sleep characteristics, having a regular working life, unemployment, and education level affect the ADL of men with MS. Additionally, pain, sleep, and fatigue explain 28.1% of ADL in men. Fatigue impact significantly decreases ADL by 5.881 units in men ($P < 0.05$). In this study, both genders had similar pain levels ($P > 0.05$). A study examining the quality of life in PwMS stated that men had higher pain scores than women.[30] Pain is considered a vital sign, and relieving the pain of people with pain is an important and prioritized practice. Therefore, it was predicted that pain might adversely affect life activities in with PwMS. There were no significant differences in the current study, but men had more fatigue. In the study of Fazli and Azar, the correlation between gender, age, disease duration, and fatigue in MS patients showed that the fatigue impact level of men was quite high.[40] It has been emphasized that fatigue associated with insomnia reduces motivation, energy, and social, family, academic, and professional performance.[41] Although the fatigue impact significantly affected men's ADL in this study,

Anens *et al*.[19] (2017) stated that the fatigue impacts were similar in both genders. In this study, sleep quality was poor in both genders. In the relevant literature, PwMS frequently experiences sleep problems, and this causes fatigue, which is the most common symptom of MS.[42] This study found that with PwMS in both men and women, sleep disturbance increased fatigue and reduced ADL. When the existing literature is examined, the study findings in which pain, fatigue, sleep, and ADL were predicted by gender in PwMS are quite limited.

When considering the regression model parameters based on gender, women and men have similar parameters, including regular working life, educational level, and unemployment, regarding sociodemographic characteristics in the model. According to the study findings, women's ADL was significantly affected by fatigue and the effect of housework that produced fatigue, while men were significantly affected by poor sleep quality.

Study limitations

The study data were collected online, and the number of participants cannot be generalized universally. Additionally, the patients' MS types were not studied.

Conclusions

According to the results of this study, it was determined that women with PwMS had a negative impact on their DLA when they experienced important and very important fatigue, while poor sleep quality in men had a negative impact on DLA. For future studies, focusing on fatigue in women with PwMs and the mechanisms underlying sleep problems in men will be helpful. Healthcare providers should consider the cumulative effects of pain, fatigue, and sleep problems when they give services. Furthermore, healthcare providers should train patients to manage pain, fatigue, and sleep problems. Knowing how to manage these symptoms can positively affect patients' DLA.

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Availability of data and material

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Conflicts of interest

There are no conflicts of interest.

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