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Research Article

What Effects Can Expressive Writing Have on Sexual Dysfunction in Women with Multiple Sclerosis? A Randomized Controlled Trial

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Background. Sexual dysfunction is a common complication in women with multiple sclerosis due to limitation in physical and mental functioning. Expressive writing as a psychological intervention can significantly improve sexual dysfunction in women with other diseases. *Aim.* The aim of the current study was to determine the effect of expressive writing on sexual dysfunction in Iranian women with multiple sclerosis. *Methods.* A randomized controlled trial with a Solomon four-group design was conducted on 116 Iranian women with MS in February 2021. Participants were randomly assigned into two control subgroups of A_1 (without pretest) and A_2 (with pretest) and two intervention subgroups of B_1 (without pretest) and B_2 (with pretest). Expressive writing was conducted for six weeks at home including morning pages (writing three pages about everything that comes to mind everyday), date with inner child (once a week), and performing weekly creative assignments. Sexual dysfunction was assessed using MSISQ-19 before the intervention in two groups of A_2 and B_2 and follows in immediately, four weeks and eight weeks after the intervention in all subgroups. The control group was provided with routine care of treatment. Data were analyzed using the intention to treat method. $P < 0.05$ was considered significant. *Results.* Twenty-nine women were analyzed in each subgroup. Although expressive writing had a positive and significant effect on primary, tertiary, and overall sexual dysfunction in B_2 intervention subgroup compared with A_2 control subgroup ($P \leq 0.001$), it could not improve secondary sexual dysfunction. Since tertiary sexual dysfunction was related to psychological aspects and the present intervention was also a subset of psychotherapy, most of the changes were observed at this level, which included a decrease of 7-8 points. Comparison between the two groups of with and without pretest in each of the control and intervention groups revealed that completing the pretest questionnaire did not have a significant impact on sexual dysfunction score. *Conclusion.* As a cost-effective and noninvasive intervention, expressive writing can be used along with the main treatment for women suffering from multiple sclerosis to improve sexual dysfunction.

1. Introduction

Multiple Sclerosis (MS) is an autoimmune demyelinating neurological disease and chronic disease of the central nervous system that is relatively common. This disease can cause paralysis as well as disturbance of sensory and vestibular systems *via* damaging the axons and oligodendrocytes [1–3].

A total of 2.8 million people are estimated to live with MS worldwide (35.9 per 100,000 population). MS prevalence has increased in every world region since 2013 but gaps in prevalence estimates persist and the mean age of diagnosis is 32 years [4]. Women are 3 to 4 times more likely to be afflicted than men [5, 6]. Even though Iran is considered a low-risk area for MS, disease prevalence has been reported to range from 5.3 to 74.3 per 100,000 individuals in different regions of the country [7]. Given that MS is often observed in young people, especially women, and the most common age of onset is from 20-40 years [3, 8, 9], it can be assumed that women of childbearing age are the most vulnerable people to this disease [10].

Multiple sclerosis is characterized by a variety of symptoms such as muscle cramps, fatigue, pain, bladder and intestinal problems, sexual problems, and cognitive and emotional disorders [11]. It also causes infertility and sexual dysfunction in women, which appear to be due to the effects of MS on the hypothalamic-pituitary-gonadal axis, resulting in interference in the production of sex hormones, sexual function, and reproductive function in patients with the disease [12].

Sudden onset of MS is a stressful event in the life of young women [13] because they suddenly experience a long-term illness that is accompanied by functional, social, and economic limitations [14]. Multiple sclerosis threatens the personal independence and ability to participate effectively in the family and community and it leads people to the lack of self-competency and self-confidence, and can change their paths of life [15].

Since people at the age of disease onset are usually sexually active and at the peak of personal and familial responsibilities, they might experience sexual problems that would potentially lead to further loss in their quality of life [16]. Sexual dysfunction is classified into three categories, primary, secondary, and tertiary, in patients with MS. The primary type is caused by demyelination lesions in the brain and spinal cord and directly impairs sexual sensation and responses. This disorder includes decreased or absence of libido, changes in orgasm, decreased vaginal lubrication, and decreased vaginal muscle tonicity. The secondary type is due to limitations in sexual activities and changes in sexual function related to physical problems, drug interventions, and complications from treatment of symptoms including fatigue, weakness and pain, impaired bladder and bowel function, and cognitive impairment. The third type is related to psychological, emotional, social, and cultural issues that affect sexual feelings and responses, including changes in self-image, insecurity, and anxiety about sexual satisfaction, sense of guilt, and depression. Ultimately, sexual problems can pose many challenges and affect the family hearth [17].

In general, the prevalence of sexual dysfunction is variable and ranges from 34% to 85% in women with MS [18, 19]. The prevalence of sexual dysfunction was 51.9 per 100,000 Iranian women in 2015 [18–20]. In a previous study, 81.9% of the Iranian women with MS reported sexual dysfunction, and 74.7% were suffering from primary sexual dysfunction, 37.5% had secondary sexual dysfunction, and 44.5% had tertiary sexual dysfunction [21].

In the initial writing paradigm, designed by Pennebaker from 1994 to 1999, participants were asked to write their deepest thoughts and experiences about stressful and traumatic events [22]. Writing, either at home or in a clinical environment, has been recently taken into consideration [23]. Some other pioneers in the field of expressive writing, such as Gillie Bolton, considered the "creative writing" as a powerful part of psychological interventions [24].

People with high anxiety are very sensitive and are constantly trying to hide their emotional states and other negative feelings. They may also negatively evaluate the slightest adverse life event as an extremely dramatized event [25]. When an experience has a regular structure, its emotional effects can be easily managed. Expressive writing of emotions, along with reinforcing problem-solving, prevents unpleasant feelings in the individual. In this way, negative emotions and experiences gradually withdraw from an individual's conscious thoughts [26].

If we assume that people deal with their problems by preventing the expression of emotions and hiding stress, this inhibition can damage the immune system by activating the hormonal system and the sympathetic system. The process of emotional disclosure is used to reduce immune system disorders [27]. Expressive writing can significantly improve sexual dysfunction in women who have been sexually abused in childhood [28].

Since no similar study has been performed before, the effect of expressive writing on sexual dysfunction in patients with MS is unknown. Depression was recognized as a consequence of psychological issues related to sexual dysfunction [29], and writing emotions could significantly improve: (1) the mean of general health indicators of anxiety and depression in patients with MS [30], (2) immune system [27], and (3) sexual dysfunction in other target groups [28]. Due to the high cost of treatment for patients with MS [31], expressive writing can be considered as an affordable potential intervention. The purpose of the current study was to determine the effect of expressive writing on levels of sexual dysfunction in Iranian women with MS.

2. Materials and Methods

This was a randomized trial with a control group that was conducted in a specialized clinic for neurological diseases and MS in February 2021 in Tehran. Sampling was performed after obtaining a letter from the ethics committee and IRCT code (IRCT20110629006917N4).

Inclusion criteria were as follows: married Iranian women aged 18 to 45 years, literacy, diagnosed with MS for at least six months, also we need to enter women suffering from sexual dysfunction; which was determined based

on having a score of 4 or 5 in one of the items of the intimacy and sexual activity questionnaire in MS [32], had sex at least once a month during the last month [33], couples were not on any psychiatric drugs, alcohol, hallucinogenic substances affecting sexual function (based on patients' statement), were not suffering from another chronic disease apart from MS, were not pregnant or breastfeeding, did not experience any significant stressful life event which could impact on quality of life or caused depression, anxiety, or upsetness such as the death or loss of relatives during last three months before starting the study, access and ability to use social media such as WhatsApp, and did not communicate with other study participants (*e.g.*, were not a member of a shared social media group). After reviewing the inclusion criteria, a disability score was calculated based on the doctor's diagnosis and patients with scores of more than 4.5 were considered ineligible, because a negative correlation was observed between the Female Sexual Function Index global score and age and Expanded Disability Status Scale [34]. Expanded Disability Status Scale (EDSS) was used as a golden standard for assessing the extent or severity of the disability in patients with MS. Participants were excluded from the study if they did not wish to continue participating in the study.

The study had a Solomon four-group design. It is sometimes used in social science, psychology, and medicine. It can be used if there are concerns that the treatment might be sensitized by the pretest. Also, we can measure the impact of pretest questionnaires on attitudes and mindsets of research units [35]. Therefore, there were two subgroups of control (A_1 and A_2) and two subgroups of intervention (B_2 and B_1). We completed posttest and pretest MSISQ-19 questionnaires only in a control subgroup (A_2) and an intervention subgroup (B_2), while the posttest questionnaires were filled up in all subgroups [36] (Figure 1).

Since the intervention required training from the researcher, blinding could not be done. One of the authors (L.A.) generated the random allocation sequence, and the other one (B.A.) enrolled participants, and assigned them to interventions. Participants were randomly assigned to four subgroups. Randomization was based on a table of random numbers from the http://www.randomization.com, and sampling was continued until the sample size was completed in each subgroup.

The sample size was determined considering a confidence level of 95% and power of 90%, assuming that the effect size of expressive writing on the sexual dysfunction variable would be at least 10.2 compared with baseline, with a standard deviation of 15.5 reported in the same study [37]. Thus, the sample size was equal to 29 per subgroup, according to the Solomon four-group design. Due to the use of intention-to-treat analysis method in current study, sample volume loss was not considered.

After the researcher's study description, participants were assured that they would receive all treatments related to the disease irrespective of their participation in the study. A contact number was also provided to research units in case they had any questions and required guidance. Patients signed an informed consent form and were assured that their information would remain confidential.

The individual session was held for each participant of two intervention subgroups after the doctor's visit and before leaving the center for an hour; methods of intervention, techniques, and assignments of expressive writing were explained based on the book entitled "The artist way" [38]. The content of intervention, assignments, and techniques was also given verbally to all individuals in both intervention groups. Participants were also told that if they felt mood swings during the procedure, they could be given a free visit by a clinical psychologist in the research team. The individuals left the center immediately after the training session, and since participants revisit by doctor in this center was every three months, the chances of reconnecting with other study participants were low, so the individuals did not return to the center until the end of the intervention.

In general, the duration of the intervention was six weeks. The intervention had three main portions. (1) Morning pages (i.e. writing three pages a day of the notebook that was provided to the participants): There is no wrong way to write morning pages, and the purpose of these pages is not to end up with the right artwork or writing, just to move your hand on the paper and write everything that comes to mind. Even if they do not think of anything, write three pages in a row, "I do not think of anything.", (2) Go on a date with Inner child: going to a preplanned tour and entertainment that would not be canceled as much as possible and buying a small gift for themselves. People did not take anyone with them to the appointment, and they were told that this appointment was an opportunity to listen to what was inside you. This method was performed to cultivate awareness once a week for two hours, (3) creative assignments (e.g. remembering childhood and drawing a child's playroom, naming three heroes in life, a description of imaginary lives, etc.), with an average of 10 to 14 creative assignments per week, and assignments varying from week to week [38].

Written assignments were performed by participants at home to protect patients' privacy and comfort due to the movement disorder. We also asked them to perform writing, preferably in a quiet environment, and at the earliest opportunity after waking up. To follow up on the intervention, the researcher recalled the writing process during a telephone call with participants of both groups once in a week during six weeks. In addition, the tasks performance of intervention group was evaluated by following questions each week:

(i) How many days a week have you written your morning pages this week?

(ii) Did you go on a date with your inner child this week?

(iii) What percentage of assignments have you generally finished?

(iv) Did you notice any improvement in your mood this week?

The research tools included the demographic and disease characteristic forms and the Persian version of The Multiple Sclerosis Intimacy and Sexuality Questionnaire-19 (MSISQ-19).

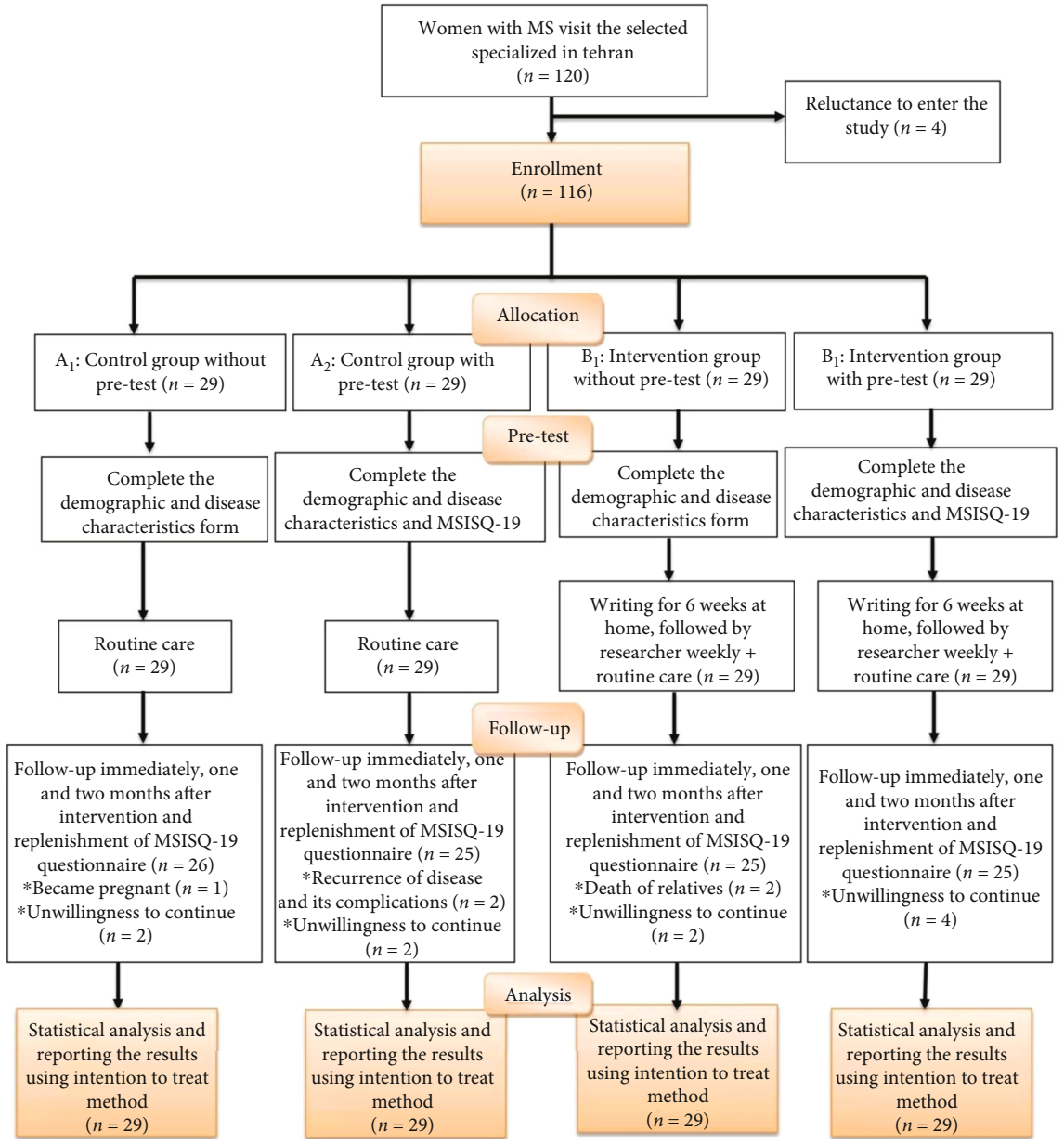

Figure 1: flow diagram of study steps.

Demographic and disease characteristic form was prepared after the literature review and guidance of the research team and was approved by three faculty members for obtaining the validity.

The Persian version of the MSISQ-19 had 19 questions that assessed the sexual dysfunction on three subscales: primary, secondary, and tertiary sexual dysfunction. The Persian version of the questionnaire was used by Mohammadi et al. [39] in 2014 using the standard Forward-Backward method, and then its face and content validity were qualitatively determined. Cronbach's alpha coefficient was 0.90 for total MSISQ-19 score, with values of 0.85, 0.90, and 0.78 for the subscales assessing primary, secondary, and tertiary sexual dysfunction, respectively. In addition, there was a positive and significant correlation between all dimensions of scale, including primary, secondary, and tertiary sexual dysfunction ($P < 0.01$) ($0.92 \leq r \leq 0.67$). The convergent validity of sexual dysfunction was assessed by the Female Sexual Function Index (FSFI) and the FSFI score correlated with thetotal MSISQ-19 score ($r = -0.54$, $P = 0.01$). According to the results, the questionnaire had the necessary reliability and validity in order to measure sexual activity and intimacy in women with multiple sclerosis [40]. In addition, the validity of this questionnaire was also confirmed by three faculty members in the current study.

The questionnaires were measured four times, including before the intervention (for groups with control A_2 and intervention B_2 pretests), immediately after the intervention, fourth weeks, and eighth weeks after the intervention in all four groups.

The intention-to-treat analysis was conducted and all patients, who were randomly assigned to the groups, were included in the posttest analysis regardless of the completion of the intervention, Whether the guidelines were followed or not. Descriptive analysis was conducted by reporting frequency, percentage, mean, and standard deviation. ANOVA, Kruskal–Wallis, and chi-square tests were used to assess the homogeneity of all four subgroups, depending on the type of the variable and their data distribution. Since the distribution of findings was not normal; Nonparametric tests such as Mann–Whitney *U* and Friedman were used. Data entered the SPSS software version 26 after collecting the questionnaires. $P < 0.05$ was considered as significant level.

3. Results

A total of 116 women suffered from MS were included in the study, 29 of whom were in each of the A_1 and A_2 control subgroups and B_1 and B_2 intervention groups. In both intervention groups, all participants completed the intervention in any quantity.

Data distribution was measured using the Kolmogorov-Smirnov test ($P < 0.05$), and investigating the Skewness and Kurtosis values were not between 1 to -1, so the sexual dysfunction scores (pretest, posttest at baseline, fourth, and eighth weeks follow-ups) in all four subgroups were not normally distributed.

In general, there was no significant difference between any of the sociodemographic characteristics and disease status in the four groups. Characteristics of the participants of A_1 and A_2 control subgroups and B_1 and B_2 intervention subgroups have been shown in Table 1.

More than half of the participants in both control (55.2%) and intervention (67.2%) groups had a university degree, and 46.6% of those in the control group and 43.1% in the intervention group had a job.

The results of the performance evaluation of the participants in the intervention group showed that although the B_1 intervention group was more active than the B_2 group in all three techniques of expressive writing, there was no significant difference between the two subgroups in performance of intervention (Table 2).

As mentioned in the inclusion criteria, all subjects were included in this study with a diagnosis of sexual dysfunction (earn a score of more than 4 in each item). In a descriptive comparison of sexual dysfunction's levels in women with MS at the beginning of the study in the B_2 intervention and A_2 control groups, we concluded that the most common sexual dysfunction was related to tertiary sexual dysfunction and the least was related to secondary sexual dysfunction (Table 3). Although, after the intervention in the experimental B_2 group, primary and tertiary sexual dysfunction decreased in all follow-up points, so that in the last follow-up, tertiary sexual dysfunction was lower than that in the other two levels.

The mean and standard deviation of pretest and posttest sexual dysfunction levels of the participants in three follow-ups of immediately, four and eight weeks after the intervention, have also been shown in Table 4. It is noteworthy that the reduction in the scores indicates a decrease in sexual dysfunction and an improvement in the patient's condition.

The results of the Mann–Whitney *U* test showed that the control and intervention groups (in the two subgroups of A_2 and B_2) were not significantly different in sexual dysfunction in pretest.

In the B_2 intervention group, based on the results of Friedman test, expressive writing had a positive and significant effect on all levels of sexual dysfunction and total sexual dysfunction score ($P < 0.001$), but a significant difference was not observed in the A_2 control group in the research process.

The results of Mann–Whitney *U* test in comparing the effect of expressive writing on the levels of sexual dysfunction between A_2 control group and B_2 intervention group compared to pretest showed a significant difference between the two groups in terms of comparing the first posttest score with the pretest score, the second posttest score with the pretest score, and the third posttest score with the pretest score in primary, tertiary, and total sexual dysfunction ($P \leq 0.001$) (Table 5). Therefore, the effect of the intervention was consistent on the primary, tertiary, and overall scores of sexual dysfunction in comparison with pretest.

The Solomon's four-group design was used to investigate the effect of pretest on the research process. For this purpose, Mann–Whitney *U* test was performed to compare two control groups of A_1 and A_2 and two intervention groups of B_1 and B_2. The results showed that there is generally no significant difference between control subgroups and intervention subgroups in levels of sexual dysfunction other than third follow-up of tertiary sexual dysfunction in intervention subgroups, so it seems that the most effective factor in reducing sexual dysfunction is mainly intervention and the frequency of completing the questionnaire did not have a significant impact.

4. Discussion

The results of the present study showed that expressive writing could significantly improve the scores of primary and tertiary sexual dysfunction levels and the overall score in women who suffered from MS. Since there was no similar previous study, it seems that our study was the first of its kind. In the following, justification of the effects of expressive writing on three levels of sexual dysfunction is provided.

Primary sexual dysfunction: Primary sexual dysfunction was initially the second most common level in both groups (A_2 and B_2). In the B_2 intervention group, this level decreased significantly with the progress of the study but, compared to the other two levels, it was the most common level among participants at the end of the study.

As psychological problems have a significant effect on sexual dysfunction and decreased libido in women [41], the positive effect of expressive writing on primary sexual dysfunction caused by changes in libido is not unimaginable. It is noteworthy that in a study to investigate the effect of expressive writing on sexual dysfunction in women with a history of sexual abuse in childhood, sexual dysfunction was divided into three categories: libido disorder, arousal

Table 1: Demographic and disease characteristics of participants in control and intervention subgroups.

Variables	Groups						P value
	Control			Intervention			
	A1 Without pretest	A2 With pretest	Total	B1 Without pretest	B2 With pretest	Total	
Age M ± SD	32.24 ± 5.13	31.10 ± 5.69	31.67 ± 5.40	33.72 ± 7.53	34.96 ± 6.73	33.84 ± 7.08	$P = 0.27$[a] F =6.21
Husband's age Mean ± SD	37.72 ± 5.62	36.03 ± 6.76	36.87 ± 6.22	38.86 ± 8.12	39.68 ± 7.13	38.84 ± 7.49	P = 0.43[b] $H = 2.74$
Marietal duration Mean ± SD	10.03 ± 5.51	8.34 ± 6.32	9.22 ± 5.88	11.10 ± 7.72	10.82 ± 7.52	10.96 ± 7.56	$P = 0.43$[a] $F = 0.25$
Number of childern Mean ± SD	1.37 ± 1.01	1.17 ± 1.00	1.27 ± 1.00	1.13 ± 1.02	1.13 ± 0.83	1.13 ± 0.92	$P = 0.75$[b] $H = 4.18$
Number of sex per month Mean ± SD	2.20 ± 1.39	2.44 ± 1.57	2.32 ± 1.47	2.79 ± 1.26	2.48 ± 1.29	2.63 ± 1.28	$P = 0.16$[b] $H = 5.03$
Duration of medication Mean ± SD	4.79 ± 2.80	3.79 ± 2.22	4.29 ± 2.56	5.48 ± 5.38	5.24 ± 3.20	5.36 ± 3.26	$P = 0.37$[b] $H = 1.19$
Duration of diagnosis M ± SD	4.62 ± 2.41	4.03 ± 2.14	4.32 ± 2.28	5.62 ± 3.44	5.34 ± 3.34	5.48 ± 3.36	$P = 0.24$[b] $H = 3.12$
EDSS Mean ± SD	1.58 ± 0.68	1.48 ± 0.50	1.46 ± 0.59	1.79 ± 0.90	1.89 ± 0.90	1.84 ± 0.89	$P = 0.11$[b] $H = 5.86$
Education N (%)							
Diploma and lower	13 (44.8)	13 (44.8)	26 (44.8)	12 (41.4)	7 (24.1)	19 (32.8)	$P = 0.30$[c]
Higher than diploma	16 (55.2)	16 (55.2)	32 (55.2)	17 (58.6)	22 (75.9)	39 (67.2)	$Chi^2 = 3.59$
Husband's education N (%)							
Diploma and lower	16 (55.2)	15 (51.7)	31 (53.4)	14 (48.3)	12 (41.4)	26 (44.8)	$P = 0.75$[c]
Higher than diploma	13 (44.8)	14 (48.3)	27 (46.6)	15 (51.7)	17 (58.6)	32 (55.2)	$Chi^2 = 1.20$
Occupation N (%)							
Housewife	14 (48.3)	17 (58.6)	31 (53.4)	16 (55.2)	17 (58.6)	33 (56.9)	$P = 0.84$[c]
Employed	15 (51.7)	12 (41.4)	27 (46.6)	13 (44.8)	12 (41.4)	25 (43.1)	$Chi^2 = 0.83$
Husband's job N (%)							
Employed	27 (93.1)	26 (89.7)	53 (91.4)	29 (100)	27 (93.1)	56 (96.6)	$P = 0.40$[d]
Unemployed	2 (6.9)	3 (10.3)	5 (8.6)	0 (0)	2 (6.9)	2 (3.4)	Cramer's $V = 0.15$
Economic situation N (%)							
Undesirable	3 (10.3)	5 (17.2)	8 (13.8)	5 (17.2)	8 (26.7)	13 (22.4)	$P = 0.33$[c] $Chi^2 = 6.81$
Relatively desirable	20 (69.0)	16 (55.2)	36 (62.1)	21 (72.4)	18 (62.1)	39 (67.2)	
Optimal	6 (20.7)	8 (27.6)	14 (24.1)	3 (10.3)	3 (10.3)	6 (10.3)	
Sex education N (%)							
Yes	19 (65.5)	20 (69.0)	39 (67.2)	19 (65.5)	20 (69.0)	39 (67.2)	$P = 0.98$[c]
No	10 (34.5)	9 (31.0)	19 (32.8)	10 (34.5)	9 (31.0)	19 (32.8)	$Chi^2 = 0.15$
Sources of sexual information N (%)							
Web	14 (48.3)	17 (58.6)	31 (53.4)	18 (62.1)	16 (55.2)	34 (58.6)	
Friends	6 (20.7)	7 (24.1)	13 (22.4)	3 (10.3)	4 (13.8)	7 (12.1)	$P = 0.09$[d]
Treatment staff	6 (20.7)	5 (17.2)	11 (19.0)	6 (20.7)	4 (13.8)	10 (17.2)	Cramer's $V = 0.25$
Experience of peers	3 (10.3)	0 (0)	3 (5.2)	2 (6.9)	5 (17.2)	7 (12.1)	

(a): ANOVA, (b): kruskal wallis, (c): chi square, (d): Cramer's V.

Table 2: Performance of intervention in B_1 and B_2 subgroups.

Group	B1 Without pretest				B2 With pretest			
	Morning pages (3 daily pages)	Meet to inner child		Homework	Morning pages (3 daily pages)	Meet to inner child		Homework
	Intervention							
Weeks	Morning pages performance	Done	Undone	Percentage	Morning pages performance	Done	Undone	Percentage
	Mean ± SD	*N* (%)		%	Mean ± SD	*N* (%)		%
1	4.44 ± 1.32	26 (89.7)	3 (10.3)	57.24	4.37 ± 1.37	25 (86.2)	4 (13.8)	53.10
2	4.93 ± 1.38	28 (96.61)	1 (3.4)	58.27	4.51 ± 1.66	23 (79.3)	6 (20.7)	54.82
3	4.27 ± 1.46	25 (86.2)	4 (13.8)	56.89	4.17 ± 1.28	25 (86.2)	4 (13.8)	53.76
4	4.51 ± 1.42	29 (100)	—	58.62	4.24 ± 1.09	26 (89.7)	3 (10.3)	55.51
5	4.86 ± 1.15	25 (86.2)	4 (13.8)	61.03	4.48 ± 1.66	24 (82.8)	5 (17.2)	57.24
6	5.10 ± 1.11	26 (89.7)	3 (10.3)	62.75	4.65 ± 1.60	26 (89.7)	3 (10.3)	57.93
Total	4.68 ± 0.85	—		59.13	4.40 ± 1.08	—		55.40
Test	Compare the percentage of homework performance: $Z = -0.84$ P value =0.39 Mann–Whitney U Compare the morning pages performance: $Z = -0.03$ P value =0.97 Mann–Whitney U							

Table 3: Comparison of sexual dysfunction's levels in women with MS.

Group SD levels	Control group A_2				Intervention group B_2			
	Pretest	Immediately after the intervention	4 weeks after the intervention	8 weeks after the intervention	Pretest	Immediately after the intervention	4 weeks after the intervention	8 weeks after the intervention
Primary sexual dysfunction*	69.24 ± 9.62	69.62 ± 9.81	68.32 ± 9.37	68.64 ± 9.54	70.75 ± 11.11	60.00 ± 6.76	57.03 ± 7.45	56.96 ± 7.45
Secondary sexual dysfunction**	56.70 ± 11.93	57.77 ± 10.04	56.62 ± 9.76	55.91 ± 9.66	55.40 ± 12.17	55.40 ± 9.14	50.20 ± 4.37	53.68 ± 4.95
Tertiary sexual dysfunction*	78.34 ± 15.25	76.88 ± 12.52	77.76 ± 14.30	77.60 ± 12.04	81.65 ± 10.00	48.96 ± 5.41	53.18 ± 8.19	53.44 ± 5.8

*mean × 100 ÷ 25, **mean × 100 ÷ 45.

disorder, and orgasm disorder. The results of this study showed that expressive writing improved the libido disorder by 56% ($P > 0.05$) [28]. Our results showed an improvement in primary sexual dysfunction which was related to libido.

The strongest negative correlations with depressive symptoms were found for orgasm and sexual enjoyment in women with MS [42]. In addition, writing emotions could significantly improve the mean of general health indicators of anxiety and depression in patients with MS [30]. Since primary sexual dysfunction includes changes in orgasm, expressive writing improved primary sexual dysfunction because of psychological status amelioration.

In a study entitled "Effects of written emotional disclosure on implicit self-esteem and body image", the results showed that self-esteem and body image of the intervention group (emotional disclosure) improved in four weeks after the intervention and were significantly different from the control group [23]. On the other hand, in a study by Afshari et al. [43] with the purpose of assessing the relationship between body image and sexual function in middle-aged women, a significant associations between body image and sexual desire ($P = 0.022$), sexual arousal ($P < 0.0005$), sexual orgasm ($P = 0.001$), and sexual satisfaction ($P < 0.0005$) were reported. It can probably be concluded that this intervention improved primary sexual dysfunction factors by affecting body image.

Data regarding the pattern is neuroendocrine response to sexual arousal and orgasm in human are inconsistent [44]. The stress response would be blunted during sexual arousal, and several researchers have found a pattern of decreased cortisol during sexual arousal and orgasm. These studies provided evidence that the stress response is inactive during the sexual response in women [45–48]. In addition, Smyth et al. [49] conducted a study with the aim of determining the effect of expressive writing on cortisol responsiveness in people with posttraumatic stress disorder and their results showed that expressive writing reduced neuroendocrine (cortisol) responses associated with trauma-

Table 4: Comparison of the sexual dysfunction's scores in women MS.

Sexual dysfunction levels	Follow up	Groups: Control A1 No pretest ($n = 29$) Mean ± SD (min-max)	Control A2 With pretest ($n = 29$) Mean ± SD (min-max)	Pretest effect Mann–Whitney P value	Intervention B1 No pretest ($n = 29$) Mean ± SD (min-max)	Intervention B2 With pretest ($n = 29$) Mean ± SD (min-max)	Pretest effect Mann–Whitney P value
Primary sexual dysfunction	Pretest	—	17.31 ± 2.41 (14-22)	—	—	17.69 ± 2.78 (13-22)	$P = 0.52$ $Z = -0.64$
	First posttest (immediately after the intervention)	17.72 ± 2.50 (14-21)	17.41 ± 2.45 (14-24)	$P = 0.57$ $Z = -0.55$	14.62 ± 1.15 (12-17)	15.00 ± 1.69 (12-18)	$P = 0.50$ $Z = -0.66$
	Second posttest (4 weeks after the intervention)	17.65 ± 2.60 (14-22)	17.08 ± 2.34 (13-22)	$P = 0.37$ Z = −.88	14.14 ± 1.79 (12-19)	14.26 ± 1.86 (12-20)	$P = 0.87$ $Z = -.16$
	Third posttest (8 weeks after the intervention)	17.73 ± 2.41 (14-22)	17.16 ± 2.38 (13-23)	$P = 0.33$ $Z = -0.96$	14.53 ± 1.66 (11-18)	14.26 ± 1.84 (12-20)	$P = 0.16$ $Z = -1.40$
	Fridman P value	$P = 0.57$ $Chi^2 = 1.10$	$P = 0.85$ $Chi^2 = 0.79$	—	$P = 0.22$ $Chi^2 = 2.95$	$P \leq 0.001^*$ $Chi^2 = 38.39$	—
Secondary sexual dysfunction	Pretest	—	25.52 ± 5.40 (16-40)	—	—	24.93 ± 5.48 (16-41)	$P = 0.92$ $Z = -0.09$
	First posttest (immediately after the intervention)	25.03 ± 2.52 (19-29)	26.00 ± 4.52 (17-36)	$P = 0.37$ $Z = -0.89$	24.65 ± 3.03 (19-32)	24.93 ± 4.11 (20-34)	$P = 0.85$ $Z = -0.18$
	Second posttest (4 weeks after the intervention)	25.19 ± 2.40 (19-30)	25.48 ± 4.39 (18-41)	$P = 0.82$ $Z = -0.22$	23.93 ± 2.84 (19-29)	22.59 ± 1.97 (18-26)	$P = 0.11$ $Z = -1.60$
	Third posttest (8 weeks after the intervention)	25.11 ± 2.81 (19-30)	25.16 ± 4.35 (18-41)	$P = 0.99$ $Z = -0.01$	24.14 ± 2.47 (19-29)	24.16 ± 2.23 (19-29)	$P = 0.87$ $Z = -0.15$
	Fridman P value	P =0.68 $Chi^2 = 0.76$	P =0.15 $Chi^2 = 5.22$	—	P =0.21 $Chi^2 = 3.05$	P ≤0.001∗ $Chi^2 = 12.72$	—
Tertiary sexual dysfunction	Pretest	—	19.59 ± 3.81 (13-26)	—	—	20.41 ± 2.50 (14-26)	$P = 0.50$ $Z = -0.67$
	First posttest (immediately after the intervention)	19.59 ± 3.32 (13-25)	19.22 ± 3.13 (13-24)	$P = 0.64$ $Z = -0.46$	13.41 ± 1.38 (11-16)	12.24 ± 1.35 (10-15)	$P = 0.12$ $Z = -1.52$
	Second posttest (4 weeks after the intervention)	19.61 ± 4.57 (11-28)	19.44 ± 3.58 (13-28)	$P = 0.57$ $Z = -0.56$	12.79 ± 1.56 (10-15)	13.29 ± 2.04 (9-18)	$P = 0.71$ $Z = -0.36$

Table 4: Continued.

Sexual dysfunction levels	Follow up	Groups: Control A1 No pretest ($n = 29$) Mean ± SD (min-max)	Control A2 With pretest ($n = 29$) Mean ± SD (min-max)	Pretest effect Mann–Whitney *P* value	Intervention B1 No pretest ($n = 29$) Mean ± SD (min-max)	Intervention B2 With pretest ($n = 29$) Mean ± SD (min-max)	Pretest effect Mann–Whitney *P* value
Overal sexual dysfunction	Third posttest (8 weeks after the intervention)	19.46 ± 3.93 (11-26)	19.40 ± 3.01 (13-26)	$P = 0.65$ $Z = -0.44$	13.78 ± 1.57 (11-16)	13.36 ± 1.46 (9-16)	$P = 0.04$ $Z = -2.05$
	Fridman *P* value	$P = 0.87$ $Chi^2 = 0.26$	$P = 0.84$ $Chi^2 = 0.80$	—	$P = 0.08$ $Chi^2 = 4.92$	$P \leq 0.001^*$ $Chi^2 = 54.91$	—
	Pretest	—	62.41 ± 10.26 (44-86)	—	—	63.03 ± 9.33 (44-88)	$P = 0.66$ $Z = -0.42$
	First posttest (immediately after the intervention)	62.34 ± 7.13 (47-72)	62.63 ± 7.88 (45-77)	$P = 0.91$ $Z = -0.10$	52.69 ± 3.92 (44-60)	52.17 ± 5.18 (44-65)	$P = 0.91$ $Z = -0.10$
	Second posttest (4 weeks after the intervention)	62.46 ± 8.32 (47-76)	62.00 ± 9.18 (48-88)	$P = 0.47$ $Z = -0.71$	50.86 ± 3.94 (59-44)	50.15 ± 3.97 (41-57)	$P = 0.34$ $Z = -0.94$
	Third posttest (8 weeks after the intervention)	62.31 ± 8.15 (47-77)	61.72 ± 8.78 (46-88)	$P = 0.62$ $Z = -0.48$	52.46 ± 3.06 (58-47)	51.76 ± 3.70 (44-60)	$P = 0.24$ $Z = -1.17$
	Fridman *P* value	$P = 0.88$ $Chi^2 = 0.24$	$P = 0.43$ $Chi^2 = 2.74$	—	$P = 0.09$ $Chi^2 = 4.69$	$P \leq 0.001^*$ $Chi^2 = 37.13$	—

Table 5: The differences in sexual dysfunction's score in women with MS in A_2 and B_2 subgroups compared to pre-test.

Sexual dysfunction levels	Follow up	Control (A2) Mean ± SD (min-max)	Group Intervention (B2) Mean ± SD (min-max)	Mann–Whitney *P* value
Primary sexual dysfunction	Δscore (follow1- follow0)	−2.69 ± 2.51 (-8.00–2.00)	0.10 ± 1.34 (-2.00–4.00)	$P \leq 0.001^*$ $Z = -4.83$
	ΔScore (follow2- follow0)	−0.23 ± 3.25 (-6.00–5.00)	−3.43 ± 2.87 (-8.00–0.00)	$P \leq 0.001^*$ $Z = -3.57$
	ΔScore (follow3- follow0)	−0.15 ± 3.23 (-6.00–5.00)	−3.45 ± 2.92 (-8.00–1.00)	$P \leq 0.001^*$ $Z = -3.59$
	Fridman *P* value	$P = 0.56$ $Chi^2 = 1.15$	$P = 0.11$ $Chi^2 = 4.26$	—
Secondary sexual dysfunction	ΔScore (follow1- follow0)	0.48 ± 2.76 (-6.00–9.00)	0.00 ± 4.09 (-7.00–9.00)	$P = 0.38$ $Z = -0.87$
	ΔScore (follow2- follow0)	−0.04 ± 7.32 (-17.00–17.00)	−2.34 ± 5.87 (-19.00–7.00)	$P = 0.27$ $Z = -1.09$
	ΔScore (follow3- follow0)	−0.36 ± 7.26 (-18.00–17.00)	−0.77 ± 5.88 (-17.00–9.00)	$P = 0.89$ $Z = -0.13$
	Fridman *P* value	$P = 0.02^*$ $Chi^2 = 7.45$	$P \leq 0.001^*$ $Chi^2 = 14.91$	—
Tertiary sexual dysfunction	ΔScore (follow1- follow0)	−0.36 ± 2.12 (-6.00–6.00)	−8.17 ± 3.07 (-16.00–-1.00)	$P \leq 0.001^*$ $Z = -6.36$
	ΔScore (follow2- follow0)	−0.15 ± 5.69 (-12.00–15.00)	−7.12 ± 3.36 (-16.00–0.00)	$P \leq 0.001^*$ $Z = -4.65$
	ΔScore (follow3- follow0)	−0.19 ± 5.03 (-10.00–10.00)	−7.05 ± 3.04 (-14.00–2.00)	$P \leq 0.001^*$ $Z = -4.91$
	Fridman P-value	$P = 0.72$ $Chi^2 = 0.63$	$P = 0.02^*$ $Chi^2 = 7.14$	—
Overal sexual dysfunction	ΔScore (follow1- follow0)	0.22 ± 5.61 (-14.00 – 18.00)	-10.86 ± 7.63 (-29.00 – 4.00)	$P \leq 0.001^*$ $Z = -4.96$
	ΔScore (follow2- follow0)	-0.41 ± 14.70 (-32.00–31.00)	-12.89 ± 10.24 (-42.00–6.00)	$P = 0.001^*$ $Z = -3.39$
	ΔScore (follow3- follow0)	−0.69 ± 13.99 (-31.00–22.00)	−11.25 ± 9.65 (-38.00–9.00)	$P \leq 0.01^*$ $Z = -3.04$
	Fridman *P* value	$P = 0.08$ $Chi^2 = 4.94$	$P = 0.007^*$ $Chi^2 = 9.94$	—

related memories ($P < 0.01$). Therefore, expressive writing may improve primary sexual dysfunction following orgasm betterment by reducing neuroendocrine responses.

Secondary sexual dysfunction: secondary sexual dysfunction was the lowest before the study in two groups of A_2 and B_2. At the end of the study, there was no significant change in this level but with the improvement of the tertiary sexual dysfunction, it was ranked second.

According to the findings of the present study, expressive writing did not have a significant effect on the secondary sexual dysfunction compared to the control group. One possible reason might be that secondary sexual dysfunction is affected by changes in sexual function related to physical problems, drug interventions, and the complications of treating symptoms, and psychological interventions such as expressive writing may have a more limited effect on physical problems. Therefore, the above result was not unexpected because these side effects of MS and drugs generally require medication and rehabilitation. This finding was in same direction with that of the study by Azari-Barzandig et al. [37], who examined the effect of EX-PLISSIT counseling on sexual dysfunction in women with MS.

Tertiary sexual dysfunction: tertiary sexual dysfunction level was the most common sexual problem at baseline in control (A_2) and (B_2) intervention groups, but it was decreased in B_2 intervention participants during the study and became lower than the other two levels.

Based on the results, expressive writing had a significant effect on tertiary sexual dysfunction, which is related to psychological, emotional, social, and cultural issues and affects sexual feelings and responses. Tertiary sexual dysfunction included changes in the mental self-image, insecurity, and

concern about the sexual satisfaction of the spouse, feelings of guilt, and depression. The positive effect of expressive writing as a psychological intervention at this level was estimated to be greater than the other two levels of sexual dysfuncton, and this finding seems reasonable. This finding was consistent with that reported in the study by Daneshfar et al. [50] who reported significant effect of the Ex-PLISSIT model as a psychological intervention on tertiary sexual dysfunction.

In a study aimed at assessing correlates of sexual function in male and female patients with MS, more than half (52.1%) of patients fulfilled Beck Depression Inventory criteria for depression, and these patients showed more sexual dysfunction than nondepressive individuals [42]. On the other hand, the findings of a study aimed to determine the effect of writing emotions on the rate of anxiety and depression in patients with MS showed that the index of depression and anxiety in patients with MS is high but the mean of general health indicators of anxiety and depression in the intervention group decreased significantly after the intervention. This decrease was more pronounced in cases with severe anxiety and depression. The results of this study showed that writing emotions is effective on the general health indicators of anxiety and depression of patients with MS, especially the severe form [30]. Thus, expressive writing may improve sexual dysfunction *via* affecting an individual's psychological state and reducing depression and anxiety.

In examining the effect of pretest in the two subgroups of intervention (with and without pretest), a significant difference in the third follow-up (eight weeks after the end of the intervention) of tertiary sexual dysfunction was observed. Since this difference was not observed between the two control subgroups, it is probably not related to the effect of frequency of completing the questionnaire, and might have been caused sby other confounding factors.

Thus far, only a limited number of studies have examined the effect of psychological interventions on the sexual dysfunction of people with MS as detailed in the following parts.

Christopherson et al. [51] in a clinical trial titled "A comparison of written materials vs. materials and counselling for women with sexual dysfunction and multiple sclerosis", studied two intervention groups; the first intervention group received written materials on primary, secondary, and tertiary sexual dysfunction in MS as well as additional resources (books, websites, and list of local psychologists specializing in sexual counseling) for 6 month, and the other group received the same written materials as well as three counseling sessions from the clinic; one face to face 20-30 minutes counseling session and two telephone counseling (10-15 minutes), which is followed up for 6 months. The results showed that both groups had equivalent and significant reductions in primary sexual dysfunction, which is consistent with the findings of the current study.

In a study by Hocaloski et al. [52] entitled "A mindfulness psychoeducational group intervention targeting sexual adjustment for women with multiple sclerosis and spinal cord injury", the investigators examined PED exercises (psychoeducational treatment adapted for women with disability :Education, Cognitive Behavioral Therapy, and Mindfulness-Based Therapy in five 90 min sessions at 2 weeks intervals). There was a significant difference between intervention and control groups in two subscales of FSFI, Desire, and Arousal. In our study, a positive effect of the intervention on primary sexual dysfunction that was associated with desire was also observed.

In a randomized controlled trial aimed at assessing the effectiveness of the PLISSIT model-based sexual counseling on the sexual function of women with MS who were sexually active, the results showed that all the subscales of FSFI except pain were improved significantly [53]. In addition, the result of 12 weekly sessions of sexual therapy on MS patients showed that all the subscales of FSFI except pain were improved significantly [54]. In the current study, we also did not find improvement in secondary sexual dysfunction, which was caused by physical problems including fatigue, weakness, and pain.

Most psychoeducational interventions had a positive effect on sexual dysfunction, and Frühauf et al. [55] in a systematic review showed that psychological interventions are effective treatment options for sexual dysfunction.

The results of this study can be generalized to women with MS with EDSS scores of less than 4.5. To increase the generalizability of the study results, the sampling method was mentioned in detail, and the multiple Sclerosis Intimacy and Sexuality Questionnaire-19 as an standard and special questionaire for MS was used. Also, to achieve similar results, it is necessary for the researchers to maintain virtual communication with the participants to answer questions and ambiguities.

sexual dysfunction is one of the most important and common problems of patients with MS, and ignoring it has countless negative effects on the lives of patients. Therefore, considering that the studied intervention is cost-effective and noninvasive, it can be used as an adjunctto standard treatment under the supervision of a specialist to improve the sexual function of women with MS.

Our study had limitations, as we did not measure participants' mental-psychological and physical condition, individual differences, and comprehension of patients about intervention, though random assignment of subjects may resolve this limitation. Relatively short follow-up was another limitation. Since there was a probability of doing homework at home late, the researcher followed up the intervention by calling the participants.

5. Conclusion

Expressive writing can be an effective method in improving primary, tertiary, and overall sexual dysfunction in women with multiple sclerosis. This intervention is cost-effective and noninvasive and can be used along with the standard treatment and under the supervision of a specialist for women suffering from MS to improve sexual dysfunction and ultimately the quality of their sexual life.

Data Availability

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

Ethical Approval

This article was extracted from the results of a master thesis at Iran University of Medical Sciences with the number of 15262, Iranian Registry of Clinical Trials code of IRCT20110629006917N4 and the ethical letter number of IR.IUMS.REC.1398.763.

Conflicts of Interest

The authors declare that they have no conflict of interest to the publication of this article.

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