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Original Article

# Effects of Reflexology and Progressive Muscle Relaxation on Pain, Fatigue, and Quality of Life during Chemotherapy in Gynecologic Cancer Patients

Hacer Alan Dikmen, PhD [*], Fusun Terzioglu, PhD [†]

[*] Department of Midwifery, Faculty of Health Sciences, Selcuk University, Konya, Turkey
[†] Department of Nursing, Faculty of Health Sciences, Atilim University, Ankara, Turkey

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ABSTRACT

*Purpose:* Our aim was to investigate the effect of reflexology and progressive muscle relaxation (PMR) exercises on pain, fatigue, and quality of life (QoL) of gynecologic cancer patients during chemotherapy.
*Methods:* Eighty participants were randomly assigned to one of four groups: reflexology, progressive muscle relaxation (PMR) exercises, both (reflexology + PMR), or a control group. Data were collected with a general data collection form, Brief Pain and Fatigue inventories, and Multidimensional Quality-of-Life Scale—Cancer.
*Results:* In reflexology and reflexology + PMR groups, a significant decrease in pain severity and fatigue and an increase in QoL were found ($p < .05$). In the PMR alone group, pain severity and fatigue decreased significantly ($p < .05$), but there was no significant change identified in QOL ($p > .05$).
*Conclusions:* Reflexology and PMR exercises given to gynecologic cancer patients during chemotherapy were found to decrease pain and fatigue and increase QoL.


In recent years, complementary and alternative medical (CAM) treatment options have been increasing rapidly to cope with the adverse effects of chemotherapy (Ozcelik & Fadiloglu, 2009). CAM techniques such as relaxation, reflexology, imagination, and music are beneficial for patients and have been reported to have positive effects (Kwekkeboom, Hau, Wanta, & Bumpus, 2008; Lee, Bhattacharya, Sohn, & Verrnes, 2012; Nazik, Nazik, Api, Kale, & Aksu, 2012; Ozcelik & Fadiloglu, 2009). It has been reported that women use CAM at a higher rate compared with men and also that gynecologic cancer patients use CAM more than those with other types of cancers (Kwekkeboom et al., 2008; Lee et al., 2012; Nazik et al., 2012; Ozcelik & Fadiloglu, 2009; Zeller et al., 2013). The use of CAM techniques by gynecologic cancer patients ranges between 40%-59% in several studies (Mao, Farrar, Sharon, Marjorie, & Katrina, 2007; Ozcelik & Fadiloglu, 2009; Turan, Ozturk, & Kaya, 2010; Zeller et al., 2013), whereas others have reported use as high as 60%-70% (Akgul & Akbulut, 2014; Ernst, Posadzki, & Lee, 2011).

Reflexology and progressive muscle relaxation (PMR) exercises are methods drawing attention among other CAM techniques (Sun, Kang, Wang, & Zeng, 2013). Reflexology was found to be effective in decreasing symptoms such as pain, fatigue, anxiety, high blood pressure, insomnia, and depression (Kim & Oh, 2011; Quattrin et al., 2006; Tsay, Chen, Chen, Lin, & Lin, 2008; Yang, 2005). In a meta-analysis performed in patients with different cancer types, PMR exercises were found to be more effective compared with routine care and general massage procedures among other interventions performed to decrease pain, fatigue, and insomnia (Kwekkeboom, Cherwin, Lee, & Wanta, 2010). The number of studies investigating the effects of reflexology and PMR exercises on gynecologic cancer patients is limited (Kim & Oh, 2011; Kwekkeboom et al., 2010; Tsay et al., 2008; Yang, 2005). Although studies reporting that reflexology and PMR exercises are influential in controlling symptoms experienced by cancer patients during chemotherapy are present in the literature, to the best of our knowledge there are no studies investigating a specific type of cancer where both reflexology and PMR exercises were performed together and the patients were followed through home visits. Therefore, our study can be assessed as the first research study investigating the effects of reflexology and PMR exercises on gynecologic cancer patients.

This article presents a portion of the findings from Hacer Alan Dikmen and Fusun Terzioglu's doctoral dissertation, which included two sections, one investigating pain, fatigue, and QoL, and the other on anxiety and depression.

Address correspondence to Hacer Alan Dikmen, PhD, Department of Midwifery, Faculty of Health Sciences, Selcuk University, Konya, Turkey, 42250.
*E-mail address:* alanhacer@gmail.com (H.A. Dikmen).

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The main hypothesis ($H_0$) of our study is that reflexology and/or PMR exercises have no effects on pain, fatigue, and QoL. Our sub-hypotheses ($H_1$) are that reflexology and/or PMR exercises decrease pain in gynecologic cancer patients; ($H_2$) in gynecologic cancer patients, reflexology and/or PMR exercises decrease fatigue; and ($H_3$) in gynecologic cancer patients, reflexology and/or PMR exercises lead to an increase in QoL.

## Methods

### *Study Aim and Design*

This is a single-blind, randomized controlled study consisting of three intervention groups and one control group. We aimed at determining the effects of reflexology and PMR exercises on gynecologic cancer patients' pain, fatigue, and QoL during chemotherapy and their effects independent of analgesics and pain medications on gynecologic cancer patients. The patients admitted to the hospitals for chemotherapy were randomly assigned via a random number table to one of the four groups by the researcher (H.A.D.) (Fig. 1). Reflexology and PMR exercises were implemented during home visits. All patients were warned not to take analgesics either orally 60 minutes before or intravenously 30 minutes before the interventions, and the data were collected when the patients were out of the effects of analgesics or other pain medications. After the interventions, the inventories were filled in either by the patient alone or with the help of a relative or friends. At the beginning, the patients were kept blinded to the other groups, whereas the researcher (H.A.D.) had information about which groups the patients were included in. Later both researchers were also kept blinded on statistical analysis.

### *Participants*

Participants included those diagnosed with uterine, ovarian, and cervical cancers at grades I-III and treated with the second or third cycle of chemotherapy. Patients receiving radiation therapy were excluded from the study. Exclusion criteria also included those with hemorrhage; with the risk of increased hemorrhage and emboli; with a history of epilepsy, a psychatric disorder, paraplegia, or thrombosis; and with bladder or kidney stones. Those with fractures, dislocations, and open injuries in the lower extremities were also excluded because they would not be able to receive foot reflexology (Tabur & Basaran, 2009; Wilhelm, 2009).

### *Data Collection*

The study was performed in patients admitted for chemotherapy at the outpatient clinics of a university hospital in the province of Konya and two university hospitals and one state hospital in the province of Ankara between December 2013 and July 2015. The sample size was calculated as 80 patients with the odds ratio (OR) of 5% and the statistical difference between groups as 92.8% of power. Using a random number table, the researcher (H.A.D.) randomly assigned each patient to one of four groups, each of which contained 20 individuals. Data were first taken either from the patient herself or with the help of a relative or friend on admission to the hospitals. Then, reflexology and PMR exercises were performed during home visits, and the data were recollected and evaluated during home visits at weeks 3, 8, and 12. The patient was blinded to which patients were assigned to which groups, whereas the researcher was aware of what groups each patient was assigned. Both researchers were blinded to the statistical analysis until after the study completion.

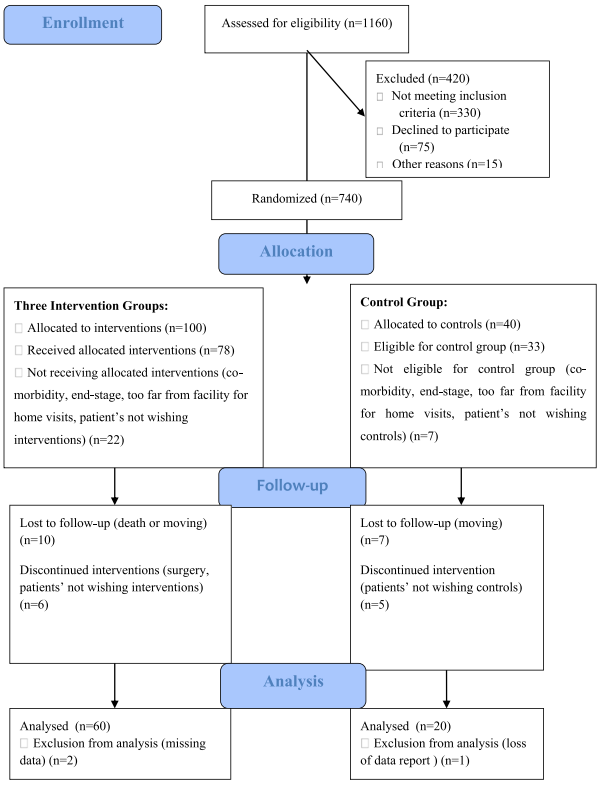


**Figure 1.** Flow diagram of the study.

### *Interventions*

#### *Reflexology*

To perform the interventions, we placed the patient in a private room with sufficient light and warm to make the patients feel relaxed. While performing reflexology sessions, only the researcher (H.A.D.) and the patients were allowed to be present in the room. Foot hygiene was performed on all patients, and no cream or lotion was applied on their feet. We asked the patients to bare their feet and positioned patients' legs by lifting the feet a little and placing a small pillow under their knees to prevent muscle fatigue. Reflexology was performed at least 1 hour after meals.

The study design and intervention techniques were explained to each patient, who then signed an informed consent. If the patients took analgesics either orally 60 minutes or intravenously 30 minutes earlier than the intervention, the intervention was delayed to distinguish between the effects of intervention and those of the analgesic. Therefore, for the home visits, the patients were called by the researcher to evaluate the condition, and the visits were then performed according to the following arrangements. A reflexology session usually lasts for 30 minutes; therefore, two sessions were performed for a total of 60 minutes at each of the 16 home visits within an 8-week period.

All sessions of reflexology were started by giving controlled pressure with the thumbs or index fingers to the patients' feet. Then the reflex points on the right foot, such as brain (frontal lobe), thyroid, upper lymphs, diaphragm, lungs, adrenal glands, liver, spinal cord, sciatic nerve, waist, and solar plexus, were stimulated for 15 minutes for relieving fatigue. Then, the same was performed for the left foot, and the reflex points, such as brain, waist, upper and lower lymphs, intestines, and solar plexus, were stimulated for 15 minutes for relieving pain (Tabur & Basaran, 2009; Wilhelm, 2009). While performing reflexology, we had no unnecessary

conversation with any patients. During the session, we did ask whether the patients felt relaxed. At the conclusion of the session, we recommended that they drink lots of water to remove toxins from the body.

*Progressive Muscle Relaxation Exercises*

To perform PMR exercises, all interventions were performed in a private room with sufficient light and warmth to make the patients feel relaxed during the study. No other individuals were allowed to enter the room during the sessions. While performing exercises, the patients were asked to wear casual and comfortable clothes. Exercises, as with reflexology, were individually performed as 16 home visits for each patient twice a week as two sessions, each for 20 minutes, for 8 weeks under the supervision of the researcher.

Muscle groups used for PMR exercises are toes, feet, legs, calves, butt, thighs, abdominal muscles, back muscles, chest, hands, biceps/triceps, shoulders, neck, face, and tongue (Kartal, 2011). In the PMR exercise sessions, patients took deep breaths in as muscles were tightened and breathed out as they were relaxed, progressing from the foot up to the face muscles (i.e., bottom to top). In our study, PMR exercises were performed at least 1 hour after meals. If the patients took up analgesics either orally 60 minutes or intravenously 30 minutes earlier than the intervention, the intervention was delayed to distinguish between the effects of intervention and those of the analgesic.

*Ethical Aspects of the Study*

The study was approved by the local ethical board (IRB number IRB99950669/1015), and written formal consent was obtained from the intuitions where the study was conducted (see Appendix A).

*Data Collection Tools*

*Brief Pain Inventory*

Developed by Cleeland in 1989, the 15-item Brief Pain Inventory (BPI) is a Likert-type 0-10 scale used to investigate the severity of pain and its effects on QoL of patients with cancer or other chronic disorders (Reis, Coskun, & Beji, 2006). The score from the inventory is calculated by dividing the total score by the number of items. The BPI measures the severity of pain and interference caused by pain using 0-10 scales. In addition, the level of pain assessed by the BPI can be divided into categories of mild (1-4), moderate (5-6), and severe (7-10) pain based on the amount of pain-related interference with function (Cleeland, 2009; Serlin, Mendoza, Nakamura, Edwards, & Cleeland, 1995). The validity and reliability of Turkish version of the scale was reported by Yesilbalkan (2005), and the researcher calculated the Cronbach $\alpha$ value of the BPI as .98. In our study, the Cronbach $\alpha$ values for the severity of pain and QoL were calculated as .87 and .98, respectively, as consistent with those found in literature (Serlin et al., 1995; Yesilbalkan, 2005).

*Brief Fatigue Inventory*

The Brief Fatigue Inventory (BFI) was developed for the rapid assessment of fatigue severity for use in both clinical screening and clinical trials. The BFI consists of two subdimensions, one for evaluating severity of fatigue with three items, and the other evaluating the effects of fatigue on daily life with six items. All nine items are scored between 0-10. The first three items ask patients to rate the severity of their fatigue at its "worst," "usual," and "now" during normal waking hours, with 0 being "no fatigue" and 10 being "fatigue as bad as you can imagine." The other six items assess the amount that fatigue has interfered with different aspects of the patient's life during the last 24 hours. These interference items include general activity, mood, walking ability, normal work (includes both work outside the home and housework), relations with other people, and enjoyment of life. The interference items are measured on a 0-10 scale, with 0 being "does not interfere" and 10 being "completely interferes (Mendoza et al., 1999). The reliability and validity of the BFI were reported by Yesilbalkan (2005), reporting the Cronbach $\alpha$ as .97 (Yesilbalkan, 2005). However, the researchers found the Cronbach $\alpha$ values for the severity of fatigue and QoL as .82 and .98, respectively.

*Multidimensional Quality-of-Life Scale—Cancer*

Developed by Ferrell, Dow, & Grant (1995), the Multidimensional Quality-of-Life Scale—Cancer (MQOLS-CA) is a 33-item scale that evaluates five dimensions of QoL (i.e., physical well-being, psychological well-being, social well-being, and spiritual well-being). On the scale, patients are instructed to circle a number from 0-10 indicating their responses to questions about their lives. A total MQOLS score and subscale scores are calculated, with higher scores reflecting a better QOL. Each item in the scale is scored between 0-10, and by dividing the total score to the number of items, an average score is calculated for each patient. As the total score increases, QoL of patients increases. The score of 0-2 indicates that QoL is too poor, 3-4 indicates poor QoL, 5-6 indicates medium QoL, 7-8 means that QoL is good, and 9-10 indicates that QoL is at the highest level. The reliability and validity of Turkish version of the MQOLS-CA were reported as a 41-item scale by Reis et al. in 2006. The Cronbach $\alpha$ for the scale was found to be .97 (Reis et al., 2006). As slightly different from the score by Reis et al. (2006), we found the Cronbach $\alpha$ for the MQOLS-CA to be .86.

*General Data Collection Form*

A 12-item questionnaire prepared by the researchers from a review of the literature was composed of the following sections (Nazik et al., 2012; Quattrin et al., 2006; Reis et al., 2006; Sun et al., 2013). The first section included the diagnostic features of the disorder. Questions 2-8 included demographic features such as age, marital status, educational level, and social security. The ninth asked about obstetric features, and the tenth elucidated the medical history of the patient. The last two questions ascertained the reason for the patient's hospital admission and whether the patient had previously received any alternative, complementary, or supportive treatments.

*Statistical Analysis*

In the assessment of our data, the Statistical Package for Social Sciences (SPSS 20.0 for Windows, IBM Corp., Armonk, NY, USA) software was used. The appropriateness of the data for normal distribution was tested via the Kolmogorov-Smirnov test. For average differences of two independent groups, the independence two-sampling $t$ test was used, and when the number of groups was more than two, the findings were analyzed with the one-way analysis of variance (ANOVA) test. If a difference was identified as a result of the ANOVA test, the Tukey test, one of the post hoc tests, was used. As to dependency, when the groups were paired, the paired sampling $t$ test was used. When the number of groups was more than two, the repeated-measure one-way ANOVA test was used. For the significance of difference between two percentages, one of the $\chi^2$ or Fischer exact tests was used (Alpar, 2010).

The sociodemographic and disease features of the patients constituted the independence variables in the study. The dependent variables in the study were mean scores of the BPI, BFI, and MQOLS-CA. The coefficients of internal consistency in the inventories were calculated, and their power analyses were performed. For all the analyses, a $p$ value $< .05$ was considered to be significant.

## Results

The sociodemographic and disease characteristics of the study groups were homogeneous. The mean age of the patients was 56.36 ± 10.61, 70% were married, 73.8% were illiterate or graduated from primary school, 77.5% of them had ovarian cancer, and 81.2% had grade III cancer (Table 1).

Although the differences between the scores of fatigue severity ($p = .218$) and the effects of fatigue on daily life ($p = .065$) in four groups were statistically insignificant in the first interview, the differences at the third week for fatigue severity ($p = .001$) and for fatigue effects on daily life ($p = .001$), eighth week for fatigue severity ($p = .001$) and for fatigue effects on daily life ($p = .001$), and twelfth week for fatigue severity ($p = .039$) and for fatigue effects on daily life ($p = .001$) were found to be significant. Whether the differences related to average scores of pain, fatigue, and QoL experienced by the participants on admission to hospital and at weeks 3, 8, and 12 were significant or insignificant was compared. Although mean difference of in-group fatigue severity scores between the control group ($p = .196$) and the PMR-only group ($p = .076$) was statistically insignificant, mean score of fatigue effects on daily life was detected to be significant lower in the PMR-only group than the controls ($p < .05$). Mean difference between the scores of fatigue severity and the effects of fatigue on daily life comparing reflexology ($p = .001$) and reflexology + PMR ($p = .001$) in two groups was also found to be statistically significant. At the eighth week, when interventions were completed, the lowest scores of fatigue severity (mean = 4.75 ± 0.580) and the effects of fatigue on daily life (mean = 3.35 ± 0.595) were found in the reflexology + PMR group (Figs. 2 and 3).

In our study, mean difference between the groups detected during the first interview was found to be statistically significant for pain severity ($p = .001$) but to be insignificant for the effects of pain on daily life ($p = .225$). Mean difference between in-group scores of pain severity ($p = .001$) and the effects of pain on daily life ($p = .001$) detected at the third and eighth weeks was also found to be significant. The lowest score found at the eighth week for pain severity (mean = 2.35 ± 0.449) and the effects of pain on daily life (mean = 1.80 ± 0.484) was found in the reflexology + PMR group. Mean difference found at the 12th week for pain severity ($p = .013$) and the effects of pain on daily life ($p = .017$) was statistically significant, and we considered that the difference, higher than all other groups, arose from the PMR group.

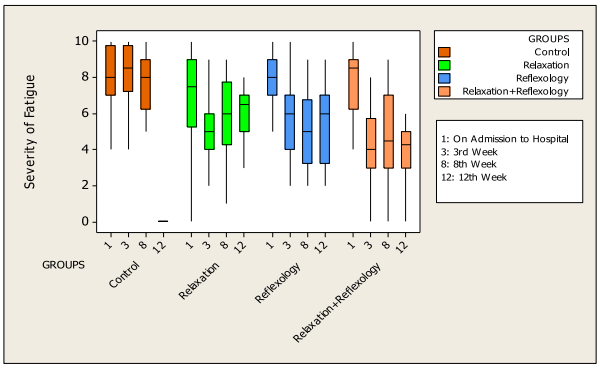


**Figure 2.** Distribution of the severity of fatigue in control and study groups after interventions (N = 80).

In the measurements of the controls during the interviews at the first, third, and eighth weeks, mean difference between pain severity ($p = .001$) and the effects of pain on daily life ($p = .001$) was statistically significant. The difference stemmed from the measurements at the eighth week, and the scores of pain severity and the effects of pain on daily life were found to be lower at the eighth week (mean = 6.40 ± 0.351), compared with the scores at the first (mean = 8.10 ± 0.289) and third weeks (mean = 8.10 ± 0.228).

As to pain severity, the difference between the scores at the first ($p = .001$), eighth ($p = .001$), and twelfth ($p = .013$) weeks in relaxation, reflexology, and reflexology + PMR groups was statistically significant. The difference arose from the first interview in all groups. Mean scores detected at the third, eighth, and twelfth weeks in terms of pain severity were found to be lower compared with those at the first week.

Although the difference in PMR group at the first, third, eighth, and twelfth weeks regarding the effects of pain on daily life was

**Table 1**
Demographic and Clinical Characteristics of Four Groups (N = 80)

| | Control | Relaxation | Reflexology | Relaxation + Reflexology | Total |
|---|---|---|---|---|---|
| Age, Mean ± SD | 57.45 ± 2.57 | 57.15 ± 2.0 | 54.90 ± 2.39 | 56.0 ± 2.56 | 56.36 ± 10.61<br>$F = 0.236$, $p = .87$ |
| Marital status | | | | | |
| Married | 16 (80.0) | 13 (65.0) | 14 (70.0) | 13 (65.0) | 56 (70.0) |
| Single | 4 (20.0) | 7 (35.0) | 6 (30.0) | 7 (35.0) | 24 (30.0)<br>$\chi^2 = 1.429$, $p = .69$ |
| Educational status | | | | | |
| Illiterate or primary school | 18 (90.0) | 13 (65.0) | 14 (70.0) | 14 (70.0) | 59 (73.8) |
| High school and higher | 2 (10.0) | 7 (35.0) | 6 (30.0) | 6 (30.0) | 21 (26.2)<br>$\chi^2 = 3.810$, $p = .28$ |
| Cancer types | | | | | |
| Ovarian cancer | 14 (70.0) | 14 (70.0) | 19 (95.0) | 15 (75.0) | 62 (77.5) |
| Others (uterine and cervical) | 6 (30.0) | 6 (30.0) | 1 (5.0) | 5 (25.0) | 18 (22.5)<br>$\chi^2 = 6.003$, $p = .11$ |
| Grades | | | | | |
| Grades I-II | 7 (35.0) | 4 (20.0) | 3 (15.0) | 1 (5.0) | 15 (18.8) |
| Grade III | 13 (65.0) | 16 (80.0) | 17 (85.0) | 19 (95.0) | 65 (81.2)<br>$\chi^2 = 6.449$, $p = .09$ |
| First diagnostic time | | | | | |
| 1-4 months | 4 (20.0) | 6 (30.0) | 9 (45.0) | 4 (20.0) | 23 (28.3) |
| 5-11 months | 8 (40.0) | 2 (10.0) | 1 (5.0) | 5 (25.0) | 16 (20.0) |
| ≥12 months | 8 (40.0) | 12 (60.0) | 10 (50.0) | 11 (55.0) | 41 (51.2)<br>$\chi^2 = 11.423$, $p = .07$ |

SD = standard deviation; $F$ = one-way analysis of variance.
Data are presented as N (%) unless otherwise stated.
$p < .05$ is significance threshold.

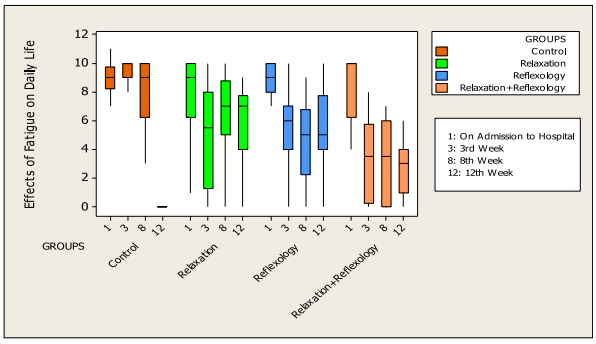


**Figure 3.** Effects of fatigue on daily life in control and study groups after interventions (N = 80).

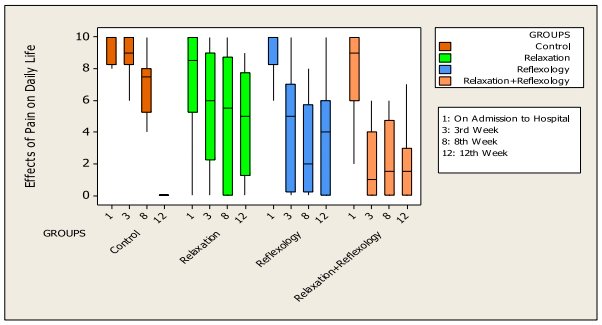


**Figure 5.** Effects of pain on daily life in control and study groups after interventions (N = 80).

found to be statistically insignificant ($p = .240$), the difference was significant in reflexology ($p = .001$) and reflexology + PMR ($p = .001$) groups. The difference in all groups was obtained from the interviews at the first week. The scores related to the effects of pain on daily life in these groups measured at the third, eighth, and twelfth weeks were found to be lower (Figs. 4 and 5).

No significant difference was present in our study between mean in-group scores of patients' QoL detected at the first week ($p = .079$); however, a significant difference was found in other measurements performed at weeks 3, 8, and 12 ($p < .005$). No significant change was found between total QoL scores of the control ($p = .094$) and PMR groups ($p = .125$) after the interventions. Between total QoL scores of reflexology ($p = .011$) and reflexology + PMR ($p = .001$) groups, however, a significant increase was identified. The highest mean QoL scores found in reflexology (mean = 5.73 ± 0.207) and reflexology + PMR (mean = 6.11 ± 0.274) groups occurred at the eighth week, when the interventions were completed (Fig. 6). In terms of reflexology and PMR exercises, patients reported no adverse effects or harm after the interventions.

## Discussion

Despite the evidence suggesting that gynecologic cancer patients often use CAM and are happy with using CAM techniques (Arye, Schiff, Steiner, Keshet, & Lavie, 2012; Chase, Gibson, Sumner, Bea, & Albert, 2014), we encountered no studies evaluating the effects of reflexology and relaxation techniques concomitantly in gynecologic cancer patients. According to the data from American Oncology Nursing Society (ONS), it was reported that the effects of reflexology and PMR exercises on the pain management of cancer patients still remain unclear (ONS, 2015). However, PMR exercises have been found to be effective in the management of symptoms arising from fatigue (Fulcher, Kim, Smith, & Sherner, 2014; Mitchell et al., 2014; Smith, Cope, Sherner, & Walker, 2014). We consider that our study is intriguing in terms of comparing and evaluating the effects of reflexology and PMR exercises on pain, fatigue, and QoL in the management of symptoms in gynecologic cancer patients on chemotherapy.

Mean scores of fatigue severity were found to be severe in the control, reflexology, and reflexology + PMR groups at the first week and moderate in the PMR group. After the interventions, the lowest and highest scores of fatigue severity were found in the reflexology + PMR and control groups, respectively. Considering the effects of fatigue on daily activities, the effects were found to decrease from severe to moderate-severe levels in PMR and reflexology groups, whereas these effects were found to decrease from severe to mild-severe levels in reflexology + PMR group. The fact that the lowest score was encountered in reflexology + PMR group in our study suggests that the use of both interventions concomitantly is more effective in the management of fatigue in gynecologic cancer patients. We noted that our patients were reluctant to perform PMR exercises and evaluated the exercises as tiring during our interventions. We consider this may be attributed to lack of habits in performing exercises in Turkish society.

Similar to our findings, reflexology interventions were reported to be effective in coping with fatigue in studies performed in cancer patients (Kim & Oh, 2011; Kohara, Miyauchi, Suehiro, Ueoka, Takeyama, & Morita, 2004; Yang, 2005). These interventions prevent obstructions and refresh bodies by dissolving the accumulation of lactic acid as microcrystals on foot, introducing them into blood circulation and allowing blood to run freely in veins (Tabur & Basaran, 2009). Therefore, reflexology interventions are considered to decrease fatigue severity in cancer patients. Our findings support the hypothesis that reflexology and/or PMR exercises decrease the level of fatigue severity in gynecologic cancer patients.

In our study, the difference in mean pain score severity was statistically significant during the follow-up home visits at weeks 3,

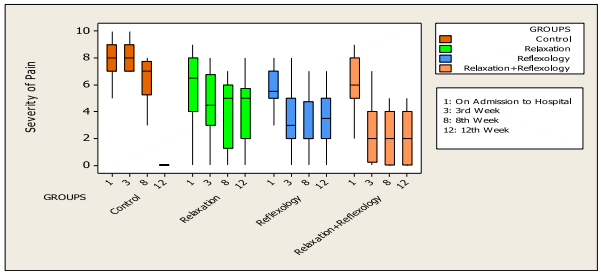


**Figure 4.** Distribution of the severity of pain in control and study groups after interventions (N = 80).

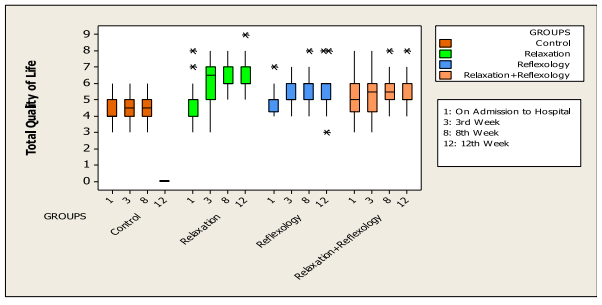


**Figure 6.** Distribution of total quality of life in control and study groups after interventions (N = 80).

8, and 12, compared with the data we obtained from the patients on admission to the hospital. Pain scores decreased significantly after interventions during home visits in all groups, except for the PMR group. The lowest pain score was in the reflexology group at week 8. The fact that pain scores were lower in groups where reflexology interventions were performed in gynecologic cancer patients indicated that reflexology interventions are more effective than PMR exercises in pain management. However, the fact that the effect of pain on the daily lives of gynecologic cancer patients was the lowest in the reflexology + PMR group suggested that when applied concomitantly, both interventions creates a synergistic effect with better outcomes.

Studies investigating the effect of reflexology (Hodgson & Lafferty, 2012; Kim & Oh, 2011; Myers, Walton, Bratsman, Wilson, & Small, 2008; Stephenson, Dalton, & Carlson, 2003; Todd, 2009; Tsay et al., 2008) and PMR exercises (Kwekkeboom et al., 2008, 2010; Lee et al., 2012) on the management of pain in cancer patients support our findings that reflexology and PMR exercises decrease the level of pain perceived by these patients. The effects of both interventions on pain scores are likely to be explained by the gate-control theory. According to this theory, normal somatosensory input, caused by reflexology and/or PMR exercises, stimulates large nerve fibers that then block the transmission of pain impulses, which travel along the small never fibers. Thus, this prevents pain signals from reaching the brain (Tabur & Basaran, 2009; Wilhelm, 2009; Wilkinson, Lockhart, Gambles, & Storey, 2008). Patients relax and perceive less pain and perceive pain severity at a lower rate. It is also considered that PMR exercises decrease the level of pain in such patients because of the decrease in the activation of the sympathetic nervous system. Our findings support the hypothesis that reflexology and/or PMR exercises decrease pain in gynecologic cancer patients.

Another challenge encountered in cancer patients during the treatment period is the decrease in QoL. The potent adverse effect of chemotherapy and chemotherapy-induced symptoms is the most significant negative factor affecting QoL (Engquist et al., 2001; Reis et al., 2006; Saevarsdottir, Fridriksdottir, & Gunnarsdottir, 2010; Wenzel, Huang, Armstrong, Waler, & Cella, 2007). In a study performed in patients with different types of cancer treated with chemotherapy (gynecologic cancer 8%), the QoL scores during chemotherapy were found to be lower compared with those after chemotherapy (Saevarsdottir et al., 2010). Overall QoL in individuals with gynecologic cancer was found to be poor in one study (Reis et al., 2006). Physical and functional well-being was found to be poorer in individuals with ovarian cancer on chemotherapy, especially in those at advanced grades compared with cancer patients not receiving chemotherapy (Engquist et al., 2001).

In our study, although QoL scores of groups had no significant difference on admission to hospital, a significant increase in QoL was found in the reflexology and reflexology + PMR groups after interventions. Several studies investigating the effects of reflexology have reported a significant increase in physical, psychological, and social well-being in patients with different types of cancer (Ernst et al., 2011; Kim & Oh, 2011; Quattrin et al., 2006; Tabur & Basaran, 2009; Tsay et al., 2008; Wilhelm, 2009; Yang, 2005). This is consistent with our finding that reflexology has a positive effect on the QoL of cancer patients. This improved QoL may be due to the decrease in pain and fatigue in these patients.

In looking at studies investigating the association between PMR exercises and QoL, however, only two studies performed in gynecologic cancer patients were encountered in literature. In these studies, a decrease in physical distress of cancer patients after PMR exercises (Goerling, Jaeger, Wlaz, Stickel, Mangler, & Meer, 2014; Pizarro et al., 2007) and an increase in psychological well-being status were detected (Goerling et al., 2014).

*Limitations*

We did not collect data on analgesic use. If the patients took analgesic either orally 60 minutes or intravenously 30 minutes before the intervention, the intervention was delayed to distinguish between the effects of the intervention and those of the analgesic. However, the effects of oral analgesics last 4-6 hours or up to 12 hours and intravenous analgesics for a shorter duration. Analgesic use may have confounded the pain and fatigue data. The small sampling may be considered another limitation in our study, and our study group was only composed of outpatients with gynecologic cancer in the provinces of Konya and Ankara in central Anatolia. Therefore, our findings cannot be generalizable to different cancer populations and other regions of Turkey.

## Conclusion

Considering that these CAM interventions have no adverse effects on women's health, reflexology and PMR exercises are recommended to be performed together by oncology nurses in a safe way to help gynecologic cancer patients coping with adverse effects of chemotherapy, such as pain and fatigue symptoms. Therefore, in-service training programs for oncology nurses should include reflexology and PMR exercise techniques. Trained nurses should be given the authorization and responsibility to perform these interventions.

## Appendix A

A written consent was obtained from each patient.

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