

Progressive Muscle Relaxation Improves Sleep Quality in Gynecological Cancer Patients Undergoing Chemotherapy: A Pre-Experimental Study

Progressive Muscle Relaxation Meningkatkan Kualitas Tidur Pasien Kanker Ginekologi Selama Kemoterapi: Studi Pre-Experimental

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Abstrak

Background: Sleep disturbances are highly prevalent among gynecological cancer patients undergoing chemotherapy. Progressive Muscle Relaxation (PMR) has been proposed as a non-pharmacological intervention to improve sleep quality.

Methods: A pre-experimental one-group pretest-posttest design was conducted among 29 patients selected by purposive sampling. PMR was performed twice daily for 10 minutes over 21 days. Sleep quality was assessed by the Pittsburgh Sleep Quality Index (PSQI). Data were analyzed using the Wilcoxon signed-rank test.

Results: PMR has a significant effect on improving sleep quality (P -value < 0.001). The PSQI score before the intervention was 10.13 ± 2.60 and decreased to 6.30 ± 1.82 after the intervention.

Conclusion: PMR significantly improves sleep quality among gynecological cancer patients undergoing chemotherapy. However, controlled trials are required to confirm these findings.

INTRODUCTION

Gynecological cancer including ovarian, cervical, and endometrial malignancies, represent a significant global health burden among women is a group of malignant diseases that affect the female reproductive system and ranks second as the highest cause of morbidity and mortality in women. According to the 2022 Global Burden of Cancer (GLOBOCAN) data, gynecological cancer accounts for 15.2% of all diagnosed cancer cases in women and as many as 15.7% of deaths reported due to these cases (Kurt et al., 2025). One of the most common problems experienced by gynecological cancer patients during chemotherapy is sleep disturbances, which are one of the side effects with the highest prevalence and have a significant impact during chemotherapy. Sleep disturbance is a common and clinically significant symptom among patients undergoing chemotherapy, adversely affecting quality of life and treatment outcomes. In research Zhao et al., (2022), sleep disturbances are more common in gynecological cancer patients (40-50%) compared to other cancer survivors (30-50%). In the study, it was also found that 85% of cancer patients who experienced sleep disorders were identified as having Obstructive Sleep Apnea (OSA), with patient fatigue levels reported in the range of moderate to severe fatigue.

Cancer patients describe subjective sleep disturbances as disturbed sleep patterns, difficulty falling asleep, frequent nighttime awakenings, restless sleep, or a combination

of these problems. These conditions not only disrupt patient comfort but also increase the risk of cancer recurrence, inhibit metabolic processes, and slow recovery (Bi et al., 2024; Chen et al., 2024). Sleep disturbances can be made more common by side effects such as fatigue and neurotoxicity caused by chemotherapy. In a study, chemotherapy-induced peripheral neuropathy (CIPN), characterized by neuropathic pain, sensory abnormalities, and motor disturbances, was a common side effect in cancer patients, especially those receiving taxane-based treatments such as docetaxel.

One non-pharmacological method that can be applied in treating sleep disorders in gynecological cancer patients undergoing chemotherapy is *Progressive Muscle Relaxation* (PMR). The PMR method involves gradually contracting and relaxing certain muscles to help patients feel more comfortable. In a study, cancer patients receiving chemotherapy reported significantly better sleep when they performed *Progressive Muscle Relaxation* (PMR) with the PSQI score of the intervention group decreasing significantly from (10.85 ± 2.08) to (5.00 ± 1.10 , $P < 0.001$).

A preliminary study conducted by researchers in the chemotherapy room at Dr. Moewardi Hospital, Surakarta, on three gynecological cancer patients undergoing chemotherapy showed that all patients experienced sleep disturbances with various clinical manifestations. Previous research on PMR in gynecological cancer patients at Dr. Moewardi Hospital has demonstrated its effectiveness in reducing anxiety levels. This study also identified sleep disturbances as one of the symptoms accompanying anxiety in cancer patients. However, to date, no research has specifically examined the effect of PMR on sleep quality as the primary outcome variable. Despite growing evidence supporting non-pharmacological interventions, limited studies have specifically examined the effect of PMR on sleep quality among gynecological cancer patients undergoing chemotherapy, particularly in low- and middle-income settings

MATERIALS AND METHOD

Study Design and Study Setting

A pre-experimental study design, one-group pretest-posttest Design. In this study, the population comprised gynecological cancer patients undergoing chemotherapy at Dr. Moewardi Regional General Hospital, particularly those in the Tulip 3 ward, totaling 266 patients in July 2025. The number in this study is based on visits by gynecological cancer patients undergoing chemotherapy, and the same patient may be recorded more than once due to repeated visits for different chemotherapy cycles. Data collection in this study was conducted from July 21 to September 18, 2025.

Sample Size

Due to limited time and resources, the researcher used the Central Limit Theorem as the theoretical basis for determining the sample size. In this study, the sampling technique used was *Non-Probability Sampling* with *Purposive Sampling*. The sample selection was based on the research objectives and predetermined inclusion and exclusion criteria, ensuring that the selected respondents had relevant characteristics and aligned with the research focus. A total of 44 respondents met the inclusion criteria. Of the 44 respondents, 14 did not complete the research process for various reasons: 4 withdrew for personal reasons, 10 could not be contacted for follow-up, and 1, after re-verification, was found not to meet the inclusion criteria (taking sleeping pills). Thus, the total number of respondents was 29.

Inclusion Criteria for Research

Patients undergoing treatment in the chemotherapy unit, aged 18 years or older, with a *Pittsburgh Sleep Quality Index* (PSQI) score of 5 or higher, and those with mobile phones, literacy skills, and willingness to participate were eligible.

Exclusion Criteria for the Study

Patients who have hearing impairments, have physical limitations that hinder their ability to perform relaxation exercises, are diagnosed with a psychiatric condition, are taking sleeping medication, and who are already practicing relaxation practices such as yoga, meditation, or breathing exercises.

Data Collection Instrument

The *Pittsburgh Sleep Quality Index* (PSQI) questionnaire was used as the research instrument. The PSQI consists of seven components (subjective sleep quality, sleep latency, sleep duration, sleep disturbances, habitual sleep efficiency, use of sleeping medication, and daytime sleep dysfunction) outlined in 19 questionnaire items.

Study Procedure

Progressive Muscle Relaxation (PMR) was performed twice daily for 10 minutes, with each movement repeated twice. The intervention was carried out in the morning and before bed at night. The participants performed the exercises independently at home for three weeks, with a Standard Operating Procedure (SOP) and a video link provided as a guide for PMR. Before the respondent does the activity, the researcher gives training and evaluates the ability to PMR. Afterward, the researcher regularly reminded participants of the PMR schedule via WhatsApp and requested proof of the exercises in the form of videos or photos.

Data Analysis

In this study, the sleep quality score was tested for normality using the Shapiro-Wilk test. The results of the normality test in this study showed a p-value <0.05, indicating that the data were not normally distributed, so the test was carried out using a non-parametric paired test. The results of the statistical analysis using non-parametric paired data (Wilcoxon) yielded a p-value < 0.05, so H₀ was rejected and H_a was accepted, indicating that progressive muscle relaxation improves sleep quality in gynecological cancer patients undergoing chemotherapy at Dr. Moewardi Surakarta Regional Hospital.

The limitations of the study are the use of a minimum sample size, due to limitations of time and the researcher. High risk for bias, caused by non-random sampling.

RESULTS

In this study, 29 patients were enrolled in a single-intervention group. The demographic characteristics of the study groups were statistically similar (Table 1). Table 2 shows that all respondents' sleep quality before the intervention was in the poor category (100.0%), with an average score of 10.24 ± 2.58 . Respondents' sleep quality improved after the intervention, with 6 respondents (20.0%) achieving the good sleep quality category. Meanwhile, the remaining 23 respondents (76.7%) still exhibited suboptimal sleep quality. Based on the graph of the average PSQI score (Figure 1), a progressive decline in sleep quality was observed from the first to the 21st day after the PMR intervention, although scores fluctuated across several measurement periods. The average PSQI score decreased from 10.10 on the first day to 6.30 on the 21st day, with a total

decrease of 3.80 points. The most significant decrease occurred on the 9th day, with a 1.1-point decrease in PSQI score compared to the previous measurement.

Table 1 Respondent Characteristics

Characteristics	Frequency	%	Mean $\pm$ SD	Median (min-max)	Mode
Age			44.07 $\pm$ 5.580	44.00 (35-55)	47 ^a
Mature (21-45 years)	17	56.7			
Late adulthood (46-65 years)	12	40.0			
Education					
Elementary School	9	30.0			
JUNIOR HIGH SCHOOL	10	33.3			
SENIOR HIGH SCHOOL	6	20.0			
College	4	13.3			
Work					
Housewife	21	70.6			
Farmer	2	6.7			
Laborer	6	20.0			
Types of cancer					
Ovarian cancer	13	43.3			
Cervical cancer	15	50.0			
Endometrial cancer	1	3.3			

^a There are several mode values. The smallest value is displayed.

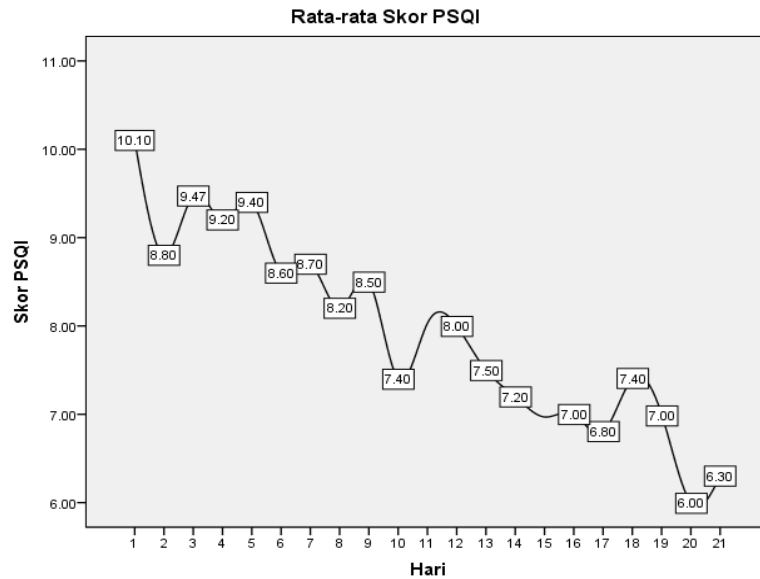
Source: Primary Data (processed using a computer program)

Table 2 Respondents' Sleep Quality

	Sleep Quality	Frequency	%	Mean $\pm$ SD	Mode	Median	Min- Max
Before intervention	Good (<5)	0	0	10.24 $\pm$ 2.58	10	10.00	6-15
	Bad (>5)	29	100				
After the intervention	Good (<5)	6	20	6.41 $\pm$ 1.743	6	6.00	3-10
	Bad (>5)	23	76.7				

Source: Primary Data (processed using a computer program)

Figure 1: Average PSQI Score



Source: Primary Data (processed using a computer program)

According to Turan et al. (2024), PMR intervention is effective in reducing physiological indicators of stress, such as blood pressure, heart rate, and respiratory rate. This decrease triggers increased parasympathetic nervous system activity, which is responsible for rest and digestion, thereby reducing the dominance of sympathetic nervous system activity associated with the fight-or-flight response. Fluctuations in daily PSQI scores can be explained by variations in individual conditions experienced by each patient. Interviews with respondents revealed that patients experienced varying daily conditions, such as excessive fatigue, activities requiring late-night sleep, and other factors that impact sleep quality. This is consistent with research (Wang et al., 2023) that states that a person's sleep parameters vary daily in response to behavioral changes (e.g., physical activity and diet), psychological changes, medication use, and physiological responses (e.g., hormonal fluctuations and inflammation), which contribute to inter-night variability.

The muscle contraction and relaxation techniques in PMR contribute to the stabilization of alpha wave activity (8-13 Hz), which allows for a state of *relaxed wakefulness*, a state of awareness, but calm. These alpha waves serve as a marker of the transition to the N1 phase, which is the transitional stage between wakefulness and sleep.

Psychologically, PMR can reduce muscle tension and activate the parasympathetic nervous system (vagal tone), which produces a calming effect. When patients focus their attention on muscle contraction and relaxation, excessive cognitive activity is reduced, and a feeling of calm is created. This mechanism can reduce presleep arousal and accelerate sleep initiation (Jaya & Thakur, 2020; Simon et al., 2022).

Table 3PSQI Components

PSQI Components	n= 29		Statistical test	
			F	P
Subjective sleep quality			12,659	0.005
Before intervention	1.63 ± 0.61	2 (1-3)		
The first week	1.60 ± 0.56	2 (1-3)		
Second week	1.53 ± 0.57	1.5 (1-3)		
The third week	1.43 ± 0.62	1 (0-3)		
Sleep latency			24,659	<0.001
Before intervention	1.93 ± 0.94	2 (0-3)		
The first week	1.73 ± 0.69	2 (1-3)		
Second week	1.50 ± 0.57	1.5 (1-3)		
The third week	1.03 ± 0.65	1 (0-3)		
Sleep duration			42,265	<0.001
Before intervention	1.47 ± 0.68	1 (1-3)		
The first week	1.23 ± 0.43	1 (1-2)		
Second week	1.03 ± 0.49	1 (0-2)		
The third week	0.67 ± 0.47	1 (0-1)		
Sleep efficiency			4,626	0.201
Before intervention	1.10 ± 1.09	1 (0-3)		
The first week	1.30 ± 0.79	1 (0-3)		
Second week	1.03 ± 0.76	1 (0-3)		
The third week	0.93 ± 0.78	1 (0-3)		
Sleep disorders			36,300	<0.001
Before intervention	1.63 ± 0.55	2 (1-3)		
The first week	1.23 ± 0.43	1 (1-2)		
Second week	1.07 ± 0.36	1 (0-2)		
The third week	1.03 ± 1.83	1 (1-2)		
Use of sleeping pills				
Before intervention				
The first week				
Second week				
The third week				
Daytime dysfunction			37,336	<0.001
Before intervention	2.33 ± 0.66	2 (1-3)		
The first week	1.97 ± 0.61	2 (1-3)		
Second week	1.77 ± 0.56	2 (1-3)		
The third week	1.53 ± 0.50	2 (1-2)		

Source: Primary Data (processed using a computer program)

The decrease in subjective sleep quality scores aligns with statements from respondents during in-person interviews, in which nearly all (90%) reported sleeping better after relaxation. This indicates an improvement in sleep quality experienced by respondents. This improvement is related to PMR's effect in relaxing the body from a state of alertness through biological and physiological mechanisms and calming the mind through psychological mechanisms. These three aspects increase the likelihood of more restful sleep, which in turn improves the quality of sleep for respondents.

DISCUSSION

A decrease in sleep latency indicates that the patient requires less time to reach sleep onset. This mechanism can be explained by PMR's effect in reducing sympathetic nervous system activity and increasing parasympathetic nervous system activity (vagal tone), which, in turn, suppresses the brain's arousal system via the GABAergic neuronal pathway. Stabilization of alpha wave signals the transition from alertness to drowsiness,

where alpha waves gradually decrease and are replaced by theta waves before NI, serving as a transition phase between wakefulness and sleep. PMR optimizes this neurophysiological transition mechanism so that sleep latency can be significantly reduced.

PMR interventions can reduce sleep duration component scores through interrelated neurophysiological mechanisms. First, they reduce central nervous system hyperarousal and high-frequency EEG activity. Second, they activate the parasympathetic nervous system and suppress sympathetic activity. Third, they modulate the HPA axis by reducing cortisol secretion. These mechanisms work synergistically to create optimal neurophysiological conditions for the onset and maintenance of quality sleep, thereby increasing sleep duration in respondents.

PMR has been consistently shown to increase slow-wave sleep (SWS) duration and shorten sleep-onset latency (Simon et al., 2022). Although there is an increase in total sleep duration and a reduction in the time required to fall asleep, these changes do not necessarily result in proportional modifications to the sleep efficiency ratio, especially if *time in bed* remains constant or even increases.

Regular, technically performed PMR reduces oxygen activation and mixing with blood. This activation reduces the effects of lactic acid, a pain-triggering factor. This exercise also reduces pain sensitivity by increasing endorphin release, helps distract attention, and ultimately helps patients cope with pain. Effective deep breathing, as patients stretch and relax muscles, allows the body to obtain the oxygen it needs by using all of the lungs. This can improve respiratory control, thereby alleviating symptoms of coughing or dyspnea, which are factors in sleep disorders (Turan et al., 2024).

Gynecologic cancer patients often experience excessive daytime sleepiness (EDS), a persistent difficulty maintaining wakefulness and alertness during the day, which can be accompanied by confusional behavior, fatigue, low energy, and impaired cognitive function. PMR addresses this condition by improving nighttime sleep quality, thereby reducing daytime dysfunction. (Simon et al., 2022) .

The limitation of the study are not used control group, small sample size, high risk for bias caused by non-random sampling, and self-reported data. These findings are consistent with previous randomized controlled trials demonstrating the effectiveness of PMR in improving sleep quality among cancer patients.

CONCLUSION

This study demonstrates that PMR is effective in improving sleep quality for gynecological cancer patients undergoing chemotherapy and experiencing sleep problems. Because PMR is inexpensive, easy to use, has no side effects, and can be used in a variety of situations, its inclusion in patient care is highly recommended. Patients undergoing chemotherapy experienced significant improvements in their sleep quality within three weeks of PMR implementation. This underscores the importance of using PMR therapy to address sleep problems and improve overall well-being in this vulnerable group.

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REFERENCES

- Bi, L., Zhang, X., Wang, L., Cai, Y., & Han, J. (2024). Subgroups of sleep quality and associated risk factors in patients with cancer undergoing radiotherapy: A cross-sectional study based on latent profile analysis. *European Journal of Oncology Nursing*, 68 (209), 102488. <https://doi.org/10.1016/j.ejon.2023.102488>
- Chan, Y.N., Jheng, Y.W., & Wang, Y.J. (2021). Chemotherapy-Induced Peripheral Neurotoxicity as A Risk Factor for Poor Sleep Quality in Breast Cancer Survivors Treated with Docetaxel. *Asia-Pacific Journal of Oncology Nursing* , 8 (1), 68–73. https://doi.org/10.4103/apjon.apjon_51_20
- Chen, MY, Zheng, WY, Liu, YF, Li, Global prevalence of poor sleep quality in cancer patients: A systematic review and meta-analysis. *General Hospital Psychiatry* , 87 (November 2023), 92–102. <https://doi.org/10.1016/j.genhosppsych.2023.12.004>
- Japardi I. (2022). Sleep Disorders Material Module, Neurology Specialist Education Study Program, Faculty of Medicine, Udayana University / Prof. IGNGNgoerah General Hospital, Denpasar 2022. *Digit by USU Digit Libr.* , 1-11.
- Jaya, P., & Thakur, A. (2020). Effect of progressive muscle relaxation therapy on fatigue and psychological distress of cancer patients during radiotherapy: A randomized controlled trial. *Indian Journal of Palliative Care* , 26 (4), 428–432. https://doi.org/10.4103/IJPC.IJPC_236_19
- Kahre, F.S., Abdi, A., Khatony, A., Salari, N., Paveh, B.K., Aznab, M., Naghibzadeh, A., & Mohammadi, M. (2024). The Effect of Jacobson Relaxation Technique on Sleep Quality of Patients With Cancer Under Chemotherapy: A Randomized Clinical Trial. *SAGE Open Nursing* , 10 . <https://doi.org/10.1177/23779608241286814>
- Kurt, G., Tarus, H. A., & Yükseltürk Şimşek, N. (2025). Assessment of Survivor Concerns Scale for Gynecological Cancer: Turkish Validity and Reliability Study. *Seminars in Oncology Nursing* , 41 . <https://doi.org/10.1016/j.soncn.2025.151954>
- Miraglia, F., Cacciotti, A., Vecchio, F., Scarpelli, S., Gorgoni, M., De Gennaro, L., & Rossini, P. M. (2025). EEG brain networks modulation during sleep onset: the effects of aging. *GeroScience* , 47 (3), 3391–3405. <https://doi.org/10.1007/s11357-024-01473-w>
- Sarı, E., Gündoğdu, F., & Semerci, R. (2024). The Effect of Progressive Muscle Relaxation Exercises on Sleep Quality in Cancer Patients Undergoing Chemotherapy: A Randomized Controlled Study. *Seminars in Oncology Nursing* , 40 (2). <https://doi.org/10.1016/j.soncn.2024.151620>
- Sigalingging, VYS (2018). Comparison Of Anxiety Levels Of Cervical Cancer Patients Undergoing Chemotherapy Before And After Progressive Muscle Relaxation (Pmr) Exercises In Surakarta .
- Simon, K.C., McDevitt, E.A., Ragano, R., & Mednick, S.C. (2022). Progressive muscle relaxation increases slow-wave sleep during a daytime nap. *Journal of Sleep Research* , 31 (5), 1–10. <https://doi.org/10.1111/jsr.13574>
- Turan, G. B., Özer, Z., & Sariköse, A. (2024). The effects of progressive muscle

- relaxation exercise applied to lung cancer patients receiving chemotherapy on dyspnea, pain and sleep quality: A randomized controlled trial. *European Journal of Oncology Nursing* , 70 (March). <https://doi.org/10.1016/j.ejon.2024.102580>
- Wang, X., Xu, Y., Li, X., Mansuri, A., McCall, W.V., Liu, Y., & Su, S. (2023). Day-to-day deviations in sleep parameters and biological aging: Findings from the NHANES 2011-2014. *Sleep Health* , 9 (6), 940–946. <https://doi.org/10.1016/j.sleh.2023.07.018>
- Wu, IHC, Balachandran, D.D., Faiz, S.A., Bashoura, L., Escalante, C.P., & Manzullo, E.F. (2022). Characteristics of Cancer-Related Fatigue and Concomitant Sleep Disturbance in Cancer Patients. *Journal of Pain and Symptom Management* , 63 (1), e1–e8. <https://doi.org/10.1016/j.jpainsymman.2021.07.025>
- Zhao, C., Grubbs, A., & Barber, E.L. (2022). Sleep and gynecological cancer outcomes: opportunities to improve quality of life and survival. *International Journal of Gynecological Cancer* , 32 (5), 669–675. <https://doi.org/10.1136/ijgc-2022-003404>