



“AeRop exercise” can improve the sleep quality of Indonesian pediatric cancer patients[☆]



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Received 13 November 2018; accepted 17 April 2019

Available online 27 June 2019

KEYWORDS

Children;
Cancer;
Fatigue;
Exercise;
Sleep

Abstract

Objective: This study identified the associations between the AeRop exercise (Indonesian abbreviation of a technique combining aerobic exercise with progressive muscle relaxation) and the sleep quality and fatigue of pediatric cancer patients undergoing chemotherapy.

Method: This quasi-experimental with control group study evaluated the AeRop exercise in 64 children with cancer undergoing chemotherapy who were recruited through a consecutive sampling method. They were assigned to intervention and control groups. Their fatigue and sleep problems were measured on day 1 and day 5 using Allen's Fatigue in Childhood Fatigue Scale and Sleep Disturbance Scale for Children. The data were analyzed using univariate analyses, dependent *t*-tests, and independent *t*-tests.

Results: There was a statistically significant difference in the sleep problems between the two groups after the AeRop exercise. However, the fatigue levels between the groups were only found to be slightly different ($p=0.05$).

Conclusion: The AeRop exercise was associated with lesser sleep problems in the pediatric patients undergoing chemotherapy. This type of light exercise can be implemented as a nursing intervention in order to improve sleep in children with cancer.

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Introduction

As a major treatment for cancer, the extensive side effects of chemotherapy are well documented. Unfortunately, these

side effects in pediatric patients can exacerbate the children's poor physical and psychological conditions. Among the most commonly reported side effects of chemotherapy are sleep problems and fatigue, which can occur frequently in children receiving chemotherapy. Sleep problem in inpatients with pediatric cancer can be influenced by the therapeutic regimens, such as the prolonged use of dexamethasone and poor sleep habits.¹ Long-term sleep problems and poor sleep quality can significantly affect the quality of life of these children.² For example, one study in Iran found that 72%–99% of pediatric cancer patients

[☆] Peer-review under responsibility of the scientific committee of the Second International Nursing Scholar Congress (INSC 2018) of Faculty of Nursing, Universitas Indonesia. Full-text and the content of it is under responsibility of authors of the article.

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undergoing chemotherapy exhibited fatigue,² while sleep problems occurred in 87% of the pediatric cancer patients.¹ However, there is currently no data regarding the prevalence of fatigue and sleep problems in children with cancer in Indonesia.

Fatigue can be quite devastating for children with cancer, and this symptom intensifies during chemotherapy.³ It can impact a patient’s adherence to therapy, daily functions, social activities, behavioral problems, and quality of life.^{2,4} In addition, fatigue can negatively affect the body’s immune system and overall healing process.⁵

Previous studies have investigated several complementary therapies that can be used to help manage fatigue and sleep problems in pediatric patients undergoing chemotherapy. Some of the complementary therapies that have been proven to reduce fatigue include relaxation techniques and aerobic exercise.⁶ Relaxation techniques using progressive muscle relaxation have been shown to better decrease a patient’s fatigue when compared to aerobic exercise done individually.⁶ However, to the best of our knowledge, no previous studies have combined relaxation techniques and aerobic exercises in order to address fatigue and sleep problems in children with cancer. Therefore, the present study aimed to determine the influence of a combined aerobic exercise and progressive muscle relaxation technique called ‘‘AeRop exercise’’ (an abbreviation of this combined exercise derived from the Indonesian language) on the sleep quality and fatigue of pediatric patients undergoing chemotherapy.

Method

A quasi-experimental pre–post study was designed with a control group, and the study population included those children with cancer who were undergoing chemotherapy. The participant recruitment was conducted using a consecutive sampling method, with the inclusion criteria as follows: 8–18 years old, currently being treated with chemotherapy, and having no musculoskeletal issues. The patients were excluded if they were unable to do the AeRop exercise.

Sixty-four children with cancer agreed to take part in this study, and they were assigned into intervention and control groups (each group had 32 children). The participants in the intervention group performed the AeRop exercise, while those in the control group received standard care. This study was conducted at a military hospital in Jakarta Indonesia for 4 weeks.

The children’s fatigue levels were measured using Childhood Fatigue Scale ($r=0.509–0.884$; Cronbach’s $\alpha=0.948$), and Sleep Disturbance Scale for Children was used to evaluate the children’s sleep problems in this study. This tool has shown good validity and reliability ($r=0.409–0.604$; Cronbach’s $\alpha=0.706$).⁷

Informed consent was sought from the parents and the children before initiating the study procedure. After receiving their consent, the first author trained the children to do the AeRop exercise using direct demonstration and a booklet. AeRop exercise consists of aerobic exercise and progressive muscle relaxation (PMR). AeRop was performed for 15 min in 5 days. The level of fatigue was measured on day 1 and day 5 after the AeRop exercise. Then, the data were

analyzed using univariate and bivariate analyses (dependent and independent *t*-tests and the Pearson’s correlation test).

Ethical approvals were obtained from the ethical committee of the Faculty of Nursing at the Universitas Indonesia and the research committee of the hospital. All of the participants’ rights were explained to them before they provided their consent, and they were protected throughout the study. The participants’ data was kept confidential.

Results

Participant characteristics

The demographic characteristics of the participants are summarized in [Table 1](#).

The mean age of the participants was 12.33 years old. More than one-half of the participants were males, had blood cancer, and were taking corticosteroids. Most of the participants were in an advanced stage of cancer, and they had been undergoing chemotherapy for 13.16 months (on average). As shown in [Table 1](#), the participants in both groups exhibited homogenous characteristics.

Fatigue and sleep quality after AeRop exercise

[Table 2](#) shows the results of the fatigue level difference analyses after the AeRop exercise between the intervention and control groups, which yielded a mean difference of 0.94. The fatigue scores between the groups were found to be slightly different ($p=0.05$); however, the sleep problem scores after the AeRop exercise showed a statistically significant difference between the groups ($p<0.05$; mean difference = -1.59).

Discussion

The results of this study suggested that the AeRop exercise had more of an influence on the sleep problems than the fatigue levels. The fatigue level scores between the groups after the intervention were not statistically significant. These findings are consistent with a previous study that reported no significant difference in the fatigue levels between the intervention and control groups after undergoing aerobic exercise.⁸ However, contrarily, one meta-analysis suggested that the aerobic exercise exhibited a slight yet significant benefit in reducing the fatigue levels of the cancer patients.⁹ Our findings are plausible because cancer-related fatigue is caused by a disruption in the body systems such that rest or light exercise cannot alleviate the fatigue. Moreover, fatigue in children with cancer hampers their daily activities. In addition, pediatric cancer patients undergoing chemotherapy perceive that their fatigue does not subside with rest or light physical exercise. In the informal interviews conducted during the data collection, the parents reported that they were concerned that undergoing exercise may worsen their children’s fatigue instead of lowering it.

Fatigue has been found to be associated with sleep problems in adolescents receiving chemotherapy.¹⁰ Our study results also demonstrated a significant difference in the

Table 1 Participants' characteristics.

Characteristic	Control (n=32)	Intervention (n=32)	Total (n=64)	p value
<i>Gender</i>				
Male	56.2 (18)	56.2 (18)	56.3 (36)	1.00*
Female	43.8 (14)	43.8 (14)	43.7 (28)	
<i>Drugs</i>				
Corticosteroids	50 (16)	53.1 (17)	51.6 (33)	0.73*
Non-corticosteroids	50 (16)	46.9 (15)	48.4 (31)	
<i>Cancer type</i>				
Blood cancer	43.8 (18)	40.6 (18)	57.8 (37)	0.63*
Solid cancer	56.2 (14)	59.4 (13)	42.2 (27)	
<i>Cancer stage</i>				
Early	40.6 (13)	12.5 (12)	35.9 (23)	0.62*
Advanced	59.4 (19)	87.5 (20)	64.1 (41)	
Age (mean ± SD)	12.97 ± 3.20	11.69 ± 2.58	12.33 ± 2.96	0.06*
Length of chemotherapy (mean ± SD)	14.22 ± 4.56	12.09 ± 6.36	13.16 ± 5.59	0.20*

SD: standard deviation.

* Significant at $p < 0.05$.**Table 2** The differences between the fatigue and sleep quality scores after the AeRop exercise.

Variable	Group	N	Mean	Mean diff*	SD	SE	95% CI	p value
Fatigue level	Control	32	10.47	0.94	2.01	0.36	0.02–1.86	0.05
	Intervention	32	9.53					
Sleep problem	Control	32	32.09	-1.59	3.14	0.56	-3.14–0.05	0.04*
	Intervention	32	33.69					

SD: standard deviation; SE: standard error; CI: confidence interval.

* Significant at $p < 0.05$.

sleep problem scores between the groups after undergoing the intervention. The children in the intervention group had a higher mean score, which indicated lesser sleep problems than those in the control group.

Practicing relaxation techniques can contribute to better sleep quality,¹¹ because they can improve the work of the parasympathetic nervous system in regulating the natural rest response of the body. The parasympathetic nervous system has the mechanisms to alleviate sleep problems in children and enhancing the sleep quality of children with cancer can improve their overall quality of life.¹² The progressive muscle relaxation in the AeRop exercise involved the practice of tensing and relaxing the body muscles, which stimulated the parasympathetic nervous system to help the children to feel rested and rejuvenated. The children may also fall asleep easier as well.

In this study, the AeRop exercise exhibited a significant difference in the sleep quality, but not the fatigue level of the pediatric cancer patients. One former study found a similar result regarding the fatigue level.⁸ However, fatigue is one of the causes of sleep problems in children with cancer.¹³ A reciprocal effect of sleep quality affecting fatigue might also apply, but this study did not explore such an effect or the relevant confounding factors. Nonetheless, the AeRop exercise can help these children to feel more relaxed and have a better night's sleep in order to prepare for the next day's activities.

Children with cancer often believe that fatigue and sleep problems are the normal impacts of cancer therapy. This situation can be explained by Levine's nursing theory, which suggests that children with cancer adapt to the illness, environment, and treatments they must undergo. Levine also posited that nursing care should focus on helping children to achieve energy integrity. Addressing fatigue and sleep problems are among the ways that one can maintain the energy integrity of these children.^{14,15}

Sleep problems may be aggravated during hospitalization, such as during treatment procedures. In the hospital setting, nurses should be sensitive when assessing and managing sleep problems and fatigue symptoms in children with cancer. Most children do not complain about fatigue directly, so nurses should actively assess and seek out the subtle cues from these symptoms.¹⁶ However, when the children are discharged from the hospital, the parents take over the primary caregiver roles. Therefore, the parents can help the children to maintain a regular light exercise regimen, such as AeRop exercise, at home.

To conclude, the AeRop exercise was linked with lesser sleep problems in the pediatric chemotherapy patients. Sleep problems and fatigue symptoms in children with cancer seem to be interrelated; thus, better sleep quality may contribute positively to a child's level of fatigue. The AeRop exercise can be implemented as an independent nursing intervention for sleep problems in children with

cancer. However, the main limitation of this study was that the confounding factors, such as the parents’ support, nurses’ roles, and environmental factors, were not examined. Further studies should be done using larger sample sizes and a more rigorous design in order to assess these confounding factors.

Conflict of interests

The authors declare no conflict of interest.

Acknowledgement

This work is supported by Hibah PITTA 2018 funded by DRPM Universitas Indonesia No. 1832/UN2.R3.1/HKP.05.00/2018.

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