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Effect of Progressive Muscle Relaxation on Sleep Quality and Side Effects of Chemotherapy in Children with Cancer: Randomized Clinical Trial

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Abstract

BACKGROUND: Sleep disturbance affects quality of life in children receiving chemotherapy.

AIM: The aim of this study was to identify the effect of progressive muscle relaxation on the sleep quality and side effects of chemotherapy in children with cancer.

METHODS: This study used randomized clinical trial with single blind method, where 30 children were allocated randomly to the control group and intervention group. The intervention group received progressive muscle relaxation twice a day, in the morning and evening, 15 min each session for 7 days. Control group received routine nursing care.

RESULTS: The study concluded there was no significant difference in the two groups on fatigue and pain. However, progressive muscle relaxation had significant relation to decreased sleep quality score.

CONCLUSION: Relaxation therapy, particularly progressive muscle relaxation, may be one of the nursing cares to improve sleep quality and reduce the side effects of chemotherapy in children with cancer.

Introduction

Cancer is a disease caused by a group of exposed cells that could spread to other healthy organs. Cancer in children is different than in adult as cancer in adult is preventable while the one in children is not [1]. Cancer cell in children originated from non-epithelial tissue thus the cell growth is faster [2], [3]. The common types of cancer in children are leukemia, lymphoma, tumor in the central nervous system neuroblastoma, and retinoblastoma [4].

International Agency for Research on Cancer in 2008 estimated there were 160,000 cancer in children cases globally with 90,000 death by cancer every year. National Cancer Institute in 2015 reported that there was approximately 10,380 cancer in children cases in the United States of America with 1000 death by cancer [5]. In 2014, population in Indonesia reached 247 million according to the World Health Organization with 40–50% were children aged 0–14 years. About 3–10% of Indonesian population were children with cancer and the mortality rate was 4–5% [6].

Cancer treatments cause pain for children; therefore, it is likely to make them feel depressed as they have life-threatening disease with continuous painful therapies [2], [3]. Chemotherapy is an effective therapy for children with cancer. It is used to treat cancer that cannot be treated with surgery or radiation therapy. It is able to kill cancer cells and prevent metastasis [7], [8]. Chemotherapy works by destroying cancer cells, but it can also affect normal cells by inhibiting their performance [9]. Common condition experienced by children with cancer in their chemotherapy is fatigue, mucositis, nausea, pain, sleep disturbance, depression, anxiety, mood swing, and behavioral changes [10], [11], [12].

Sleep disturbance often not realized by children, their parents, or health-care professionals. In general, there percentage of sleep disturbance in children reaches 30% and it increases in children with chronic disease, such as cancer [13]. Sleep disturbance in children with cancer could be influenced by stress or other factors related with their disease. These factors can be classified as direct and indirect factors. Direct factors are brain injury due to brain tumor, hydrocephalus, surgical procedures, and cranial

radiation therapy, while chemotherapy is considered as indirect factor [9]. Chemotherapy's side effects that could cause sleep disturbance are fatigue, nausea, and pain [14], [15].

Pain is one of the common symptoms experienced by patient of acute illness. Tumor growth causes pain as it compresses nerves, bones, and other surrounding organs. Pain could influence sleep quality, and sleep itself affects perception and toleration of pain on the other hand. Other causes of pain are chemotherapy side effects, lumbar puncture, and bone marrow aspiration [16]. Pain affects subjective sleep parameter of an individual, while indirectly influences fatigue [14].

A phenomenology study of adolescents with cancer treated by chemotherapy confirms the relation of fatigue to sleep disturbance. Fatigue mainly occurs as a consequence of chemotherapy side effects, which has symptoms of physical discomfort such as exhaustion, aches, limp, and others [17]. Other study conducted by Sahin and Dayapoglu regarding fatigue and sleep quality of chronic obstructive pulmonary disease (COPD) patients shows that fatigue level is inversely proportional to sleep quality [18].

Common sleep problems include difficulty to sleep, increased frequency of waking up in the middle of the night, and excessive drowsiness during the day [17]. In general, sleep disturbance affects daily activities such as decreased productivity, concentration problems, behavior changes, limp, lack of enthusiasm, unconcerned of his surroundings, problems in social interaction, and inability to recover energy after doing activities [18], [19], [20]. Sleep disturbance also influences behavior and cognitive function development of children thus affecting their study achievement [19], [21]. Sleep disturbance in children with cancer affects their quality of life, which causes their inability to cope with stress, anxiety, pain, illness, and depression that contributed to the sustainability of their chemotherapy program [9], [13].

Treatment of chemotherapy side effects improves children's internal strength and supports them in coping with their illness. Relaxation technique is a complementary therapy used to treat chemotherapy side effects [22]. Srilekha, Soumendra, and Chattopadhyay state that progressive muscle relaxation performed in three 15 min sessions weekly for two consecutive months improves concentration and reduces anxiety in children aged 9–12 years in India and Bangladesh [23]. This result is in line with Lee, Bhattacharya, Sohn, and Verres study, where progressive muscle relaxation provides relaxing effect, reduces anxiety, and improves physical and psychological patient of gynecologic cancer receiving chemotherapy by increasing posterior theta activities (3.5–7.5 Hz) and reducing midfrontal beta-2 band (20–29.5 Hz) in the later part of therapy [24].

Progressive muscle relaxation also improves breast and prostate quality of life of cancer patients receiving chemotherapy. The result of saliva testing of patients treated with four sessions of progressive muscle relaxation and guided imagery shows the decrease of amylase level. α-amylase is one of the enzymes secreted by salivary glands as a response on sympathetic stimulation. Stress response of an individual influenced by his hypothalamus–pituitary–adrenocortical axis (HPA) and sympatho-adrenomedullary (SAM) systems. Amylase and cortisol are indexes of HPA and SAM, which means that the decrease of amylase level is related to the decrease in individual's stress response. Other study concludes that progressive muscle relaxation and guided imagery are effective in reducing level of depression, pain, and anxiety in breast and prostate cancer patients [25].

Sahin and Dayapoglu explain that progressive muscle relaxation improves sleep quality of COPD patients. Their study used 70 min video as medium to explain progressive muscle relaxation, which was classified to three parts. The first part explained definition and objectives of progressive muscle relaxation for 10 min, while 30 min second part explained the relaxation techniques, and finally the third part only filled with relaxation music for 30 min. This study also used booklet to explain progressive muscle relaxation techniques. This intervention was conducted once per day for 6 weeks [18].

Progressive muscle relaxation is a non-pharmacological therapy that is inexpensive, easy, and safe. Therefore, it is necessary to investigate the relation of progressive muscle relaxation to sleep quality and chemotherapy side effects in children with cancer. The effects of sleep disturbance often unrealized by children, parents, and health-care professionals have been studied extensively. However, studies regarding sleep disturbance in children with cancer receiving chemotherapy are limited, thus sleep disturbance management is not optimal. The aim of this study was to identify the effect of progressive muscle relaxation on sleep quality and chemotherapy side effects in children with cancer.

Methods

This study used clinical trials method where authors treated intervention group to be compared with control group, where participants were classified into groups randomly. This study used single blind randomized clinical trial. Assessment was conducted with single blind where research subjects did not know which group they were [26], [27]. In this study, progressive muscle relaxation was performed in intervention group, but not in control group. Effectiveness of intervention

was assessed by comparing average of sleep quality score before and after intervention on children with cancer treated by chemotherapy. Sleep quality scoring was conducted before and after intervention for control and intervention groups.

This study conducted in Children Ward – Ground Floor and Children Ward – First Floor in Dr. Kariadi Hospital, Semarang from October – November 2016. Inclusion criteria of this study were children aged 2–18 years with cancer receiving chemotherapy, while the exclusion criteria were children who experienced fever, seizure, asphyxiate, and unconscious. Study subjects who met inclusion criteria then classified into control and intervention groups randomly. This study used block randomization to minimalize possibility of participant number imbalance between both groups.

Minimum number of samples in this study was developed from Sari's study of the effect of progressive muscle relaxation on comfort and nausea of children with cancer receiving chemotherapy in H. Adam Malik Hospital, Medan. In Sari's study, mean difference standard deviation of comfort variable in both groups was 1.36, while the mean difference before and after intervention that was considered clinically significant was 1.33 [28]. In this study, the calculated minimum number of samples per group was 22 participants, thus the total sample was 44 participants. We estimated 10% of the selected participants could not finish the study thus the corrected total number of samples increased to 49 participants. However, this study could only find 30 respondents that were divided equally into both groups.

Data were collected by pain assessment questionnaire with numeric rating scale, vomiting and nausea was assessed by rhodes index of nausea, vomiting, and retching (Rhodes INVR), PedsQL Multidimensional Fatigue Scale used to assess fatigue, and sleep disturbance was assessed by Pittsburgh Sleep Quality Index (PSQI). Validity test was conducted on 10 respondents in Children Ward – Ground Floor in Dr. Kariadi Hospital, Semarang.

Calculated r value of each question item in Rhodes INVR instrument was (0.808–0.916), while the value for PSQI instrument was (0.759–0.928), and the value for PedsQL Multidimensional Fatigue Scale instrument was (0.826–0.928). Table r value used in this study was 0.532.As calculated r value was larger than table r value; all questions in Rhodes INVR, PSQI, and PedsQL Multidimensional Fatigue Scale were valid. Reliability test was calculated using Cronbach's Alpha test. The results for Rhodes INVR, PSQI, and PedsQL Multidimensional Fatigue Scale were $\alpha = 0.967$, $\alpha = 0.978$, and $\alpha = 0.984$, respectively. This result proved that all instruments were reliable.

Data analysis was conducted to investigate difference of sleep quality, fatigue, nausea-vomiting scores before and after intervention in both groups, difference of sleep quality, fatigue, and nausea-vomiting scores between both groups after progressive muscle relaxation was performed, and average difference of sleep quality, fatigue, nausea-vomiting scores between both groups after progressive muscle relaxation was performed.

Results

In the initial stage of this study, 35 children were selected as respondents based on inclusion and exclusion criteria. However, we could not get consent from one child as his parents were resting, thus only 34 children participated in this study. Randomization using random number table with four subjects in each block was performed to allocate 18 respondents to control group and 16 respondents to intervention group. Three respondents from control group and one respondent from intervention group had worsened condition and transferred to ICU. Four respondents were then excluded and the total of 30 respondents were divided equally into two groups. Flowchart of this study is displayed in the following Figure 1.

Average pain score in both groups was obtained from 7-day assessment. Assessment on the 1st day was assumed as zero point (initial point) before progressive muscle relaxation was performed. Pain score in the following days was assessed after progressive muscle relaxation was performed and the

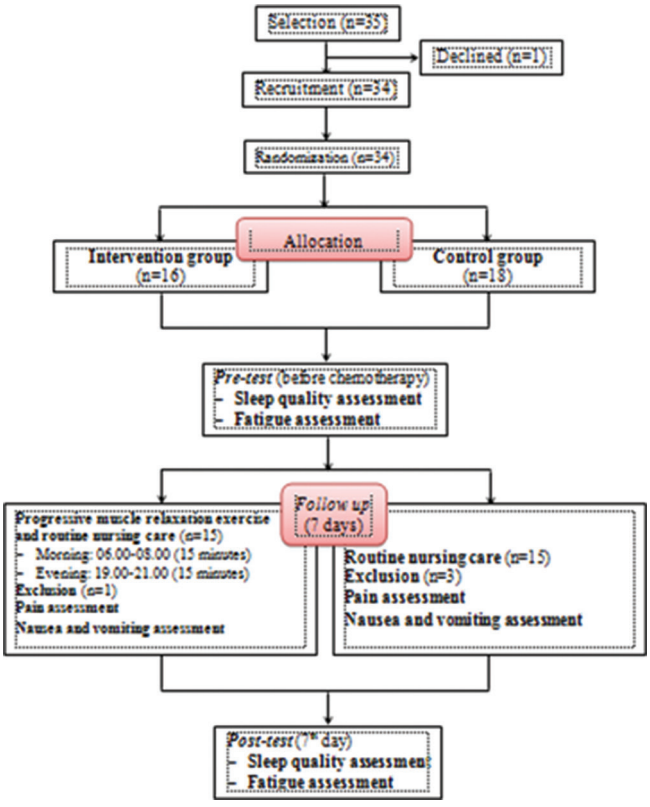

Figure 1: Flow diagram in the study

assessment of the 7th day was assumed as final point. Figure 2 shows that the average of pain scores in the 1st day was identical for both groups, with the number reached 1.67 (±1.67) for control group and 1.67 (±2.46) for intervention group. On the 2nd day, the pain score for intervention group decreased significantly to reach 0.87 (±1.40), yet it increased again on the 3rd day. The score for intervention group was decreasing until the 6th day and slightly increased on the 7th day, with the final score was 0.67 (±1.39). Meanwhile, the score for control group increased on the 4th day to reach 1.00 (±1.30) and was decreasing until the final day to reach 0.20 (±0.56). The average pain scores for 7-day assessment in control and intervention groups were 0.87 and 0.90, respectively.

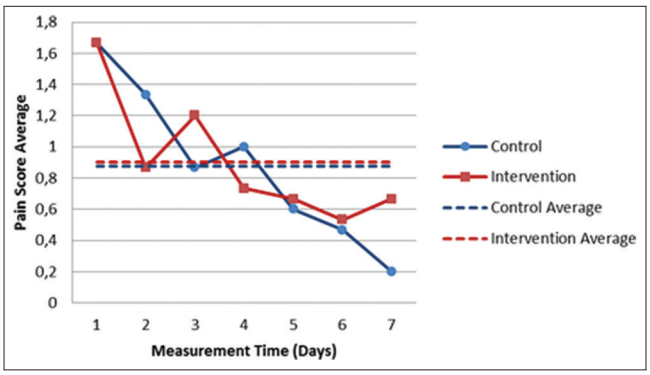

Figure 2: Curve of daily pain score average after progressive muscle relaxation for 7-days

Average nausea-vomiting score in both groups was obtained from 7-day assessment. Assessment on the 1st day was assumed as zero point (initial point) before progressive muscle relaxation was performed. Nausea-vomiting score in the following days was assessed after progressive muscle relaxation was performed and the assessment of the 7th day was assumed as final point. Figure 3 shows that the average of nausea-vomiting scores for intervention group in the 1st day 7.20 (±6.88) was higher than control group. The scores for both groups were decreasing for the next 3 days, and relatively stable on the 6th day. The score for intervention group increased on the 7th day to reach 0.80 (±2.14). In contrast, the score for control group

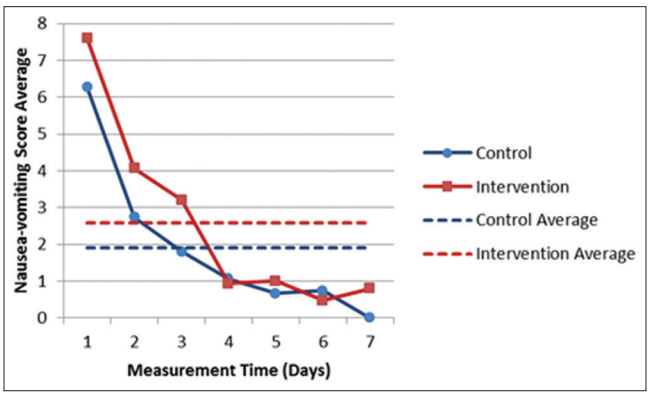

Figure 3: Curve of daily nausea-vomiting score average after progressive muscle relaxation for 7 days

continued to decrease on the 7th day to reach 0.00, which means that respondents on the control group did not experience nausea and vomiting on the final day of assessment. The average nausea-vomiting scores for 7-day assessment in control and intervention groups were 1.89 and 2.58, respectively.

Table 1 shows the improvement of sleep quality as the scores for both groups were decreased with median for control and intervention groups were 3.00 and 2.00, respectively. The difference of sleep quality scores in both groups was insignificant with respective p value for control and intervention groups were 0.468 and 0.130. The median fatigue score for intervention group decreased to reach 76.00 while the score for control group was stable at 78.00. Difference of fatigue scores was insignificant on both groups, where the p values for control and intervention groups were 0.222 and 0.733, respectively.

Table 1: Scores of sleep quality, fatigue, pain, and nausea-vomiting before and after progressive muscle relaxation

Variable	Group	Assessment	Median	Min-max	p-value
Sleep quality	Control	Before	4.00	1 – 14	0.468
		After	3.00	1 – 15	
	Intervention	Before	3.00	1 – 4	0.130
		After	2.00	1 – 4	
Fatigue	Control	Before	78.00	19 – 96	0.222
		After	78.00	11 – 100	
	Intervention	Before	82.00	47 – 97	0.733
		After	76.00	53 – 100	
Pain	Control	Before	2.00	0 – 4	0.011*
		After	0.00	0 – 2	
	Intervention	Before	0.00	0 – 8	0.042*
		After	0.00	0 – 5	
Nausea-vomiting	Control	Before	4.00	0 – 20	0.005*
		After	-	-	
	Intervention	Before	7.00	0 – 20	0.005*
		After	0.00	0 – 7	

*Significance at α 0.05.

The average pain and nausea-vomiting scores decreased in both groups. Median pain scores for both groups were identical at 0.00. Difference of pain scores were significant on both groups, where the p values for control and intervention groups were 0.011 and 0.042, respectively. Median nausea-vomiting scores for both groups were identical at 0.00. Difference of nausea-vomiting scores was significant on both groups, where p-values for control and intervention groups were identical at 0.005.

Table 2 shows scores of sleep quality, fatigue, pain, and nausea-vomiting for both groups after progressive muscle relaxation. Sleep quality of intervention group was better than control group, with the respective median score of 2.00 compared to 3.00. Sleep quality score difference between both groups was significant, with p = 0.025. Median fatigue score in

Table 2: Scores of sleep quality, fatigue, pain, and nausea-vomiting before and after progressive muscle relaxation

Variable	Group	Median	Min-Max	p-value
Sleep Quality	Control	3.00	1 – 15	0.025*
	Intervention	2.00	1 – 4	
Fatigue	Control	78.00	11 – 100	0.755
	Intervention	76.00	53 – 100	
Pain	Control	0.00	0 – 2	0.327
	Intervention	0.00	0 – 5	
Nausea-vomiting	Control	-	-	0.150
	Intervention	0.00	0 – 7	

*Significance at α 0.05.

intervention group was lower than control group, with the number reached 76.00. This means that the fatigue level of intervention group was higher than control group. Fatigue score difference between both groups was insignificant, with p = 0.755.

Pain and nausea-vomiting scores were identical for both groups, with median score of 0.00. Pain and nausea-vomiting scores difference between both groups was insignificant, with p value of pain score and nausea-vomiting score was 0.327 and 0.150, respectively.

As shown in Table 3, average sleep quality score difference of intervention group 0.53 (±1.24) was higher than control group 0.33 (±1.67). Meanwhile, average fatigue score difference of intervention group 2.20 (±12.93) was higher than control group 1.06 (±23.19). The improvement of fatigue score means that progressive muscle relaxation was able to reduce fatigue level. Average pain score difference of control group 1.46 (±1.59) was higher than intervention group 1.00 (±1.77). In contrast, average nausea-vomiting score difference of control group 6.26 (±6.47) was higher than intervention group 6.80 (±6.61). No average score difference of sleep quality, fatigue, pain, and nausea-vomiting was significant (p > 0.05).

Table 3: Average score difference of sleep quality, fatigue, pain, and nausea-vomiting after progressive muscle relaxation

Variable	Group	Mean (±SD)	p-value
Sleep Quality	Control	0.33 (±1.67)	0.443
	Intervention	0.53 (±1.24)	
Fatigue	Control	1.06 (±23.19)	0.430
	Intervention	2.20 (±12.93)	
Pain	Control	1.46 (±1.59)	0.290
	Intervention	1.00 (±1.77)	
Nausea-vomiting	Control	6.26 (±6.47)	0.916
	Intervention	6.80 (±6.61)	

Discussion

Sleep disturbance in children influenced by biological mechanism where the increase of interleukin (IL)-6 and tumor necrosis factor (TNF)-α reduce total sleep duration during the night and less sleep during the day [29]. IL-6 and TNF-α are essential cytokines as sleep management substances that increase in children suffered from obstructive sleep apnea, sleep insufficiency, and excessive drowsiness during the day. Changes in children sleep pattern caused by high level of dexamethasone treatment affect HPA and change of cytokines. Corticosteroid increases alertness and disturbs release of corticotrophin releasing hormone (CRH). CRH activates norepinephrine system that causes awake condition and slow-wave sleep [30]. Common sleep problems include difficulty to sleep, increased frequency of waking up in the middle of the night, and excessive drowsiness during the day [17].

Dexamethasone is a drug that affects sleep pattern [31]. Dexamethasone increases sleep duration and reduces frequency of waking up during the night, improves sleep efficiency, and more sleep during the day [32]. Other effects of dexamethasone are causing fatigue, irritated, insomnia, hypersomnia, mood swing, psychosis, and even consciousness fluctuation. Dexamethasone is given the induction, consolidation, and maintenance phases with dose of 6–12 mg/m^2/day. Dexamethasone is given for 2–3 years of total chemotherapy program [30].

This study results show that there was no relation of medicine to sleep quality. This contradicts other studies results which concluded that dexamethasone affected children's sleep [30], [32], [33], [34]. Study of pharmacokinetic mechanism of dexamethasone in induction phase also stated that sleep disturbance was experienced by children treated with dexamethasone. However, this study explains that pharmacokinetically, dexamethasone clearance of children is higher than adult [35]. Sleep duration improvement occurred during the day and evening in 5 days of consuming dexamethasone. This improvement returned to normal after dexamethasone was not consumed from the 16th to 15th days (washout period) and continued for the next 13 days [30].

Age is regarded as one of influencing factors of children sleep pattern [16], [36]. Yet, in our study, age did not related to sleep quality. In average, children in this study were in school age (6–12 years old) [37]. These children has varying sleep requirement based on their age, with children aged 6 years need 11–12 h of sleep in the evening while the ones aged 11 years require 9–10 h. However, children in school age often reject to sleep early as they start to feel freedom and do not care of their fatigue [38].

Some studies suggested children's sleep influenced by gender [16], [36]. However, the results of our study contradict this finding. Combs *et al*. found that children's sleep duration and schedule influenced by their age, body mass index, and ethnicity, not by their gender, family income, and parents' education background [34]. Short duration of sleep affects health status as it causes hypertension and obesity in children due to disturbance in metabolic regulation. This change also causes mood swing, depression, emotional change, and concentration problems, which affects decreased achievements in school and higher possibility of traffic accidents for adolescent [11], [39].

Sleep quality in this study had no relation with medical diagnose or children's type of cancer. Brain tumor is one type of cancer that influences sleep disturbance [16]. Since it causes dysfunction in hypothalamus; the sleep-wake management center. Decreased neuroendocrine level increases hormones fluctuation that causes sleep disturbance such as excessive drowsiness during the day [20]. Other brain injuries such as hydrocephalus, brain surgery

procedures, and cranial radiation therapy also cause sleep disturbance [9].

The result showed that progressive muscle relaxation had statistical significance to sleep quality, where there was a sleep quality improvement in children treated with progressive muscle relaxation. However, this result contradicted with Zupanec *et al*. study, where they found that progressive muscle relaxation had no statistical significance to sleep quality of children with ALL, even though there was an increased sleep duration and reduced frequency of waking up during the night. Based on our result, it can be concluded that progressive muscle relaxation had clinical benefit for children receiving chemotherapy [40].

Fatigue is an exhausted condition influenced by anemia, drugs, nausea-vomiting, metabolism disorder, hormone deficiency, pain, or infection. Anemia is a decreased number of red blood cells, which causes fatigue. The essential part of a red blood cell is hemoglobin; the low level of hemoglobin creates lack of oxygen supplied to other cells and subsequently inhibits many activities [41]. Our results showed that age, gender, medical diagnoses, and drugs had no significant relation to fatigue after progressive muscle relaxation, yet fatigue was related to chemotherapy stage. This result is in line with Utami's study that concluded age, gender, cancer type, chemotherapy type, and nutritional status have no significant relation on fatigue level of children receiving chemotherapy [42].

Nunes, Jacob, Adlard, Sekola, and Nascimento published different results where they found that age, gender, and medical diagnose were related to sleep and fatigue on children and adolescent with cancer in home care. Children and adolescent with cancer were more often experienced sleep disturbance or fatigue than general and cognitive fatigue. Their study found that adolescent experienced more fatigue than children, as age difference affects hormonal change in puberty, more social involvement, and increased anxiety, which, in turns, affects fatigue level [43].

Our result also showed there was no significant relation of progressive muscle relaxation in children with cancer to their fatigue level, yet there was an increased fatigue score which proved that there was a decreased fatigue level. This result is supported by Zupanec *et al*. study, where they found that sleep hygiene and relaxation had no statistical significance on fatigue, even though there was fatigue level change after intervention [40].

Kaushal *et al*. had different result where progressive muscle relaxation was more effective than aerobic exercises performed ±20 min in 3-week intervention [41]. Allenidekania and Sari supported this result as they found that progressive muscle relaxation was effective for reducing fatigue level of hospitalized children with cancer receiving chemotherapy [44]. This contradicting results are influenced by difference stage of chemotherapy, as there are difference regiments experienced by children, which affect their fatigue level. This analysis is supported by Yeh *et al*. study of the relation of clinical factors (hemoglobin level, chemotherapy agent, and corticosteroid use) on fatigue before and after 10-day chemotherapy for children with cancer. Their study states that children experienced fatigue on the first few days of chemotherapy cycle. The use of corticosteroid and hemoglobin level had significant relation to increased fatigue level after several days of chemotherapy, where the highest level was experienced on the 5th day of corticosteroid treatment [45].

Fatigue and sleep quality are related. Sleep disturbance during the night is one of the essential factors causing fatigue. Fatigue in turns causes drowsiness and the increased frequency of sleep during the day, which subsequently leads to sleep disturbance during the night due to fragmented sleep-wake cycle [46]. Nurses need to review the effect of fatigue on children quality of life. Nurses could performed energy management by reviewing children fatigue level, their cardio respiration response on activity (tachycardia, hemodynamic pressure, and breathing frequency), occurrence of pain, nutrition intake, and taking note of children sleep pattern and schedule.

Pain experienced by children with cancer caused by infiltration of cancer cell to other organs or tissues. Chemotherapy or radiation also causes pain due to mucositis, abdominal and anal pain caused by intestinal neuropathy as a result of vinca alkaloid therapy, esophageal pain increased gastric acid caused by high dose of corticosteroid, and spinal pain. Pain also experienced during lumbar puncture, bone marrow aspiration, and central venous catheter insertion. Pain affects an individual ability to reach deep sleep due to increased frequency of waking up, threat of repetitive pain, and alertness of more severe pain [46].

Neurological experience influences children perception on pain. Environmental and psychological factors are also significant in children perception on pain. Other factors such as age, genders, cognitive level, temperament, previous pain experience, and family and cultural background are unalterable [12]. Situational factors that can be modified are behavioral, cognitive, and emotional factors. These factors varied based on situation such as children knowledge of pain, pain treatment, and children and parents feeling on experienced pain. Children have limited pain experience, thus these situational factors have more effect on them than adults [2].

Progressive muscle relaxation in children with cancer had significant relation to pain. Meta-analysis conducted by Christaki and Yfandopoulou found that progressive muscle relaxation in children and adolescent decrease chronic abdominal pain. Progressive muscle relaxation is one of complementary

therapies that have been proven to be able to reduce stress and pain. Exercises in progressive muscle relaxation are simple, non-invasive, and easy to teach and perform anywhere anytime. Nurses play a major role in reviewing and managing pain in children with cancer. Proper pain review requires proper pain assessment tools. Comprehensive pain review includes location, characteristic, quality, duration, severity, and precipitation factor. Nurses also need to observe non-verbal pain signs. Non-pharmacological pain management could be taught by identifying relaxation technique in accordance with children ability [47].

Potential stimulating condition of anticipative nausea-vomiting is seeing and experiencing unique aroma of hospital, nurses, ward, or other things related with hospital. Children experienced this condition repeatedly thus generating manual response of anticipative nausea that has been felt even before chemotherapy. Anticipative nausea-vomiting level and severity tend to increase after repetitive chemotherapy cycle. Acute nausea-vomiting is the nausea-vomiting that occur during 24 h period after chemotherapy, while slow nausea-vomiting occur 1–7 days after chemotherapy.

Our results showed that progressive muscle relaxation in children with cancer had significant relation to nausea-vomiting. Sari's study of effect of progressive muscle relaxation on comfort, nausea-vomiting in children receiving chemotherapy in H. Adam Malik Hospital, Medan supports this result. This study used quasi-experiment pre-post-test with control group. Samples were collected consecutively, yielded in 21 respondents per group. This study found that progressive muscle relaxation improved comfort and reduced nausea-vomiting in children receiving chemotherapy [28].

Conclusion

Sleep quality and fatigue before and after progressive muscle relaxation had no significant difference in control and intervention groups, while pain and nausea-vomiting had significant difference in both groups before and after progressive muscle relaxation. The effect of progressive muscle relaxation on fatigue, pain, and nausea-vomiting showed no significant relation in control and intervention group, yet sleep quality had significant relation in both groups after progressive muscle relaxation. Difference of sleep quality, fatigue, and pain, and nausea-vomiting before and after progressive muscle relaxation showed no significant difference between control and intervention groups.

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