



The Relationship Between Fatigue and Quality of Life in Pediatric Leukemia Patients Undergoing Chemotherapy

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Abstract

Children with leukemia undergo treatment in the form of chemotherapy. The side effects of chemotherapy can lead to fatigue, which in turn may affect their daily functioning and overall quality of life. This study aims to analyze the relationship between fatigue and the quality of life in pediatric leukemia patients undergoing chemotherapy at Arifin Achmad General Hospital, Pekanbaru. The research design used is a descriptive correlational study with a cross-sectional approach. The study sample consisted of 41 children with leukemia (26 boys and 15 girls) aged 5–12 years, selected through purposive sampling at the Seruni Unit. The study utilized the PedsQL™ MFS (Multidimensional Fatigue Scale) and PedsQL™ 4.0 (Generic Core Scales) questionnaires. The results showed that the average fatigue score among the children was 44.0, indicating a moderate level of fatigue, with the majority experiencing cognitive function impairment (mean score of 16.5). The average quality of life score was 61.1, with most children experiencing physical function impairment (mean score of 22.5), and 29 respondents (70.7%) were found to have impaired quality of life. The Spearman Rank test revealed a significant relationship between fatigue and quality of life in children with leukemia undergoing chemotherapy. The findings of this study are expected to serve as a reference for improving the quality of life of children with cancer by minimizing the side effects of their treatment, thereby maintaining their overall well-being.

Keywords: Fatigue, Chemotherapy, Leukemia, Quality of Life



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INTRODUCTION

Leukemia is one of the most common types of blood cancer in children and is a major cause of morbidity and mortality worldwide. According to a report by the International Agency for Research on Cancer (IARC) in 2020, there were 474,519 new cases of leukemia and 311,594 leukemia-related deaths globally, with the highest incidence occurring in Asia (IARC, 2020). In Indonesia, the incidence of acute leukemia in children ranges from 2.5 to 4.0 cases per 100,000 children annually, equivalent to 2,000–3,200 new cases per year. This figure is slightly lower than that of the United States, which records 3.5 cases per 100,000 children (IARC, 2020). Data from the Surveillance, Epidemiology, and End Results (SEER) in 2020 also noted that leukemia accounted for approximately 3.4% of all new cancer cases and 3.8% of all cancer-related deaths (SEER, 2020). Acute lymphoblastic leukemia (ALL) is the most common form of leukemia in children, accounting for about 74% of pediatric leukemia cases (American Cancer Society, 2023). According to the World Health Organization (WHO) through the IARC, Indonesia is among the countries with the highest number of childhood cancer cases, with an estimated 8,667 cases among children aged 0–14 years in 2020, of which approximately 30–40% were leukemia (Indonesia Cancer Community, 2022). Research by Garniasih et al. (2022) also revealed that the incidence rate of ALL in Indonesian children reaches 4.32 per 100,000. Locally, data from Arifin Achmad General Hospital in Pekanbaru reported a total of 317 outpatient leukemia cases between January and May 2024 (Medical Records, RSUD Arifin Achmad Pekanbaru, 2024).

Pathophysiologically, leukemia is a hematological malignancy characterized by the excessive production of abnormal white blood cells by the bone marrow and lymphoid tissues. The proliferation of these abnormal cells disrupts the production of normal blood cells, which play vital roles in immune response, blood clotting, and oxygen transport (Chennamadhavuni et al., 2023). In children, leukemia symptoms often include paleness, weakness, fatigue, unexplained fever, bleeding, and bone pain that can make the child reluctant to walk or stand (Ministry of Health, Indonesia, 2022). Chemotherapy is the primary treatment for leukemia and works by destroying rapidly dividing cancer cells. Chemotherapy drugs may be administered orally, via intravenous injection, or infusion, depending on the cancer type and the patient's condition (Ruhyanudin et al., 2022). However, chemotherapy is also associated with various significant side effects, such as nausea, vomiting, appetite loss, hair loss, and fatigue. These side effects occur due to the collateral damage to healthy cells, particularly red blood cells that are responsible for oxygen distribution throughout the body (Hendriyeni & Allenidekania, 2022). This lack of oxygen is one of the main causes of severe fatigue in patients undergoing chemotherapy.

Fatigue in cancer patients differs from the regular tiredness experienced by healthy individuals. It is often both physical and psychological, persistent, unrelieved by rest, and disruptive to quality of life (Zielinski et al., 2019; Ambrella et al., 2021). In leukemia patients, fatigue may be exacerbated by anemia, chronic inflammation, and increased metabolic demands due to inflammatory mediators depleting the body's energy reserves (Lanser et al., 2020). A child's age also influences how fatigue manifests; children under 9 tend to show physical symptoms such as reduced play activity, while older children and adolescents may also experience psychosocial challenges, academic decline, and altered future plans (Hermalinda & Novrianda, 2016). Research by Hermalinda & Novrianda (2016) showed that both children aged <7 and >7 years had relatively high fatigue scores, 43.55% and 43.30% respectively. Younger children displayed symptoms such as drowsiness, irritability, and easy fatigue during play. School-aged children, on the other hand, exhibited fatigue through a need for daytime naps, limited outdoor play, and increased sadness. This indicates that fatigue affects not only the physical dimension but also emotional well-being and overall quality of life.

Quality of life is an important indicator for evaluating treatment outcomes in cancer patients, including children with leukemia. It reflects the child's ability to function in daily life despite illness and undergoing intensive treatment such as chemotherapy (Novrianda & Dwi, 2021). Several factors, including age, gender, parental education level, disease severity, and treatment type, influence quality of life (Dewi, 2022). Previous studies have found a significant correlation between fatigue and decreased quality of life in children undergoing leukemia treatment (Ambrella et al., 2021; Hanifia, 2018). Fernandes (2020) also reported that fatigue increases during and after the induction phase of chemotherapy. However, a different finding was reported by Satunisa (2020), who found no significant relationship between fatigue and cancer patients' quality of life. Based on the above background, it is evident that fatigue is a major clinical issue that significantly impacts the quality of life in children with leukemia. Therefore, this study aims to further explore the relationship between fatigue and quality of life in pediatric leukemia patients undergoing chemotherapy at Arifin Achmad General Hospital, Pekanbaru.

RESEARCH METHODS

This research utilized a quantitative method with a descriptive correlational design. The sample was selected using purposive sampling, consisting of 41 pediatric patients (aged 5–12 years) undergoing leukemia treatment. Data were collected using the PedsQL™ Multidimensional Fatigue Scale (MFS) to assess fatigue levels and the PedsQL™ 4.0 Generic Core

Scales to assess quality of life. The questionnaires used were previously validated and tested for reliability. Data analysis included univariate analysis and bivariate analysis using the Spearman Rank test.

RESEARCH RESULTS AND DISCUSSION

The results are presented based on the characteristics of respondents and the variables studied. This study provides univariate analysis in the form of frequency distribution and presents bivariate analysis results.

Univariate Analysis

Respondent Characteristics

Table 1. Frequency Distribution of Respondents Based on Their Characteristics

Characteristics	Frequency (n)	Percentage (%)
Gender		
1. Male	26	63.4%
2. Female	15	36.6%
Age		
1. 5 - 7 years	19	46.3%
2. 8 - 12 yeras	22	55.7%
Educational Status		
1. Not in School	13	31.7%
2. Elementary School	28	68.3%
Duration of Treatment		
1. <1 year	22	53.7%
2. 1 - 2 year	12	29.3%
3. >2 year	7	17.1%
1. Chemotherapy Phase		
2. Induction (1 - 6 weeks)	3	7.3%
3. Consolidation (9 - 12 weeks)	10	24.4%
4. Maintenance (13 - 48 weeks)	28	68.3%
Total	41	100%

Based on Table 1, the distribution of respondent characteristics shows that the majority of pediatric cancer patients were male, accounting for 63.4% of the total respondents. The most common age group was 8–12 years (55.7%). In terms of educational background, most of the children were in elementary school (SD), comprising 68.3%. Regarding the duration of treatment, the majority had been undergoing chemotherapy for less than 1 year (53.7%). In terms of the chemotherapy phase, the majority of respondents were in the [insert majority phase, e.g., maintenance phase].

Overview of Children's Fatigue

Table 2. Overview of Children's Fatigue Scores (n = 41)

Variable	Mean	Median	SD	Min - Max	95% CI
Fatigue Score	44.0	46.0	9.2	18 - 57	41.0 - 46.9

Based on Table 2, the average fatigue score among children was 44.0. According to the scoring interpretation, a score of less than 70 indicates impaired condition, while a score above 70 indicates no impairment. The lowest recorded fatigue score was 18, and the highest was 57, indicating that the majority of children experienced moderate fatigue.

Table 3. Children's Fatigue Scores by Dimension Based on the PedsQL™ Multidimensional Fatigue Scale (n=41)

Variable	Mean	SD	Min - Max
General Fatigue	13.2	3.3	6 - 20
Sleep/ Rest Fatigue	14.6	3.3	8 - 20
Cognitive Fatigue	16.0	4.0	2 - 24

Based on Table 3, the analysis from the PedsQL™ Multidimensional Fatigue Scale questionnaire shows that the majority of children experienced cognitive fatigue with an average score of 16.0, with the most frequently reported item being: "I have trouble thinking quickly," and the least frequently reported being: "I have trouble remembering what people say to me." This was followed by sleep/rest fatigue, with an average score of 14.6, where the most commonly reported symptom was: "I take frequent rests," and the least reported was: "I sleep during the day." General fatigue had the lowest average score of 13.2, with the most frequently reported item being: "I feel tired," and the least frequently reported being: "I am too tired to spend time with my friends."

Overview of Children's Quality of Life

Table 4. Overview of Children's Quality of Life Scores (n=41)

Variable	Mean	Median	SD	Min - Max	95% CI
Quality of Life Scores	44.0	46.0	9.2	18 - 57	41.0 - 46.9

Based on Table 4, the quality of life scores from the respondents show an average score of 44.0 on a scale of 0–100 (where a higher score indicates better quality of life), with the lowest score being 26 and the highest score being 76.

Table 5. Children's Quality of Life Scores Based on PedsQL™ 4.0 Generic Core Scale (n=41)

Variable	Mean	SD	Min - Max
Physical Functioning	22.5	4.1	12 - 30
Emotional Functioning	14.1	3.0	4 - 18
Social Functioning	12.0	3.5	2 - 17
School Functioning	12.4	3.5	4 - 18

The data in Table 5 show that the analysis from the PedsQL™ 4.0 Generic Core Scales questionnaire revealed that the majority of children experienced impairments in physical functioning, with an average score of 22.5. The most commonly reported symptom in this dimension was: "I feel pain/discomfort," and the least reported symptom was: "I have difficulty bathing on my own." This was followed by emotional functioning, with an average score of 14.1, where the most frequently reported symptom was: "I have trouble sleeping," and the least reported was: "I worry about what will happen to me." For school functioning, the average score was 12.4, with the most commonly reported symptom being: "I miss school because I have to go to the doctor or hospital," and the least reported was: "I forget things easily." Lastly, in social functioning, the average score was 12.0, with the most commonly reported symptom being: "I cannot do the things other children my age can do," and the least reported was: "Other children do not want to be my friend".

Table 6. Frequency Distribution of Children's Quality of Life (n=41)

Characteristics of Quality of Life	Frequency (n)	Percentage (%)
1. Impaired	29	70.7%
2. Not Impaired	12	29.3%
Total	41	100%



Based on Table 6, the majority of children's quality of life was impaired, with 29 respondents (70.7%), while 12 respondents (29.3%) reported no impairment in their quality of life.

Bivariate Analysis

Table 7. The Relationship Between Fatigue and Quality of Life in Children with Leukemia Undergoing Chemotherapy (n=41)

Variable	Mean	Median	Modus	p value
Fatigue	44.0	46.0	42	0.001
Quality of Life	61.1	62.0	62	

Based on Table 7, the results of the bivariate analysis show a p-value of ($0.001 \leq 0.05$), indicating that there is a significant relationship between fatigue and the quality of life in children with leukemia undergoing chemotherapy.

Discussion

Univariate Analysis

Respondent Characteristics

Based on the research results, the majority of respondents were male (63.4%), which aligns with the findings of Arania et al. (2021), who reported that boys suffer more from cancer than girls, partly due to the involvement of the testes and genetic factors. Males have one X chromosome, making them more vulnerable to genetic damage compared to females who have two X chromosomes as a backup (Rubin et al., 2020). Additionally, hormone levels such as estrogen, which are protective against cancer, are also lower in males. In terms of age, most respondents were aged 8–12 years (53.7%), indicating that leukemia is common in school-age children. This is supported by WHO (2018) and Rahimul (2022), who stated that leukemia affects children under 18 years old, peaking at ages 2–4 due to prenatal and perinatal factors (Ndlovu, Hlongwa, & Ginindza, 2022). According to Pui et al. (2019), during school age, the immune system in children is still maturing, making them more susceptible to mutations in blood stem cells. External factors such as poor nutrition can also increase the risk of leukemia (Parkin, 2020). The majority of children with leukemia in this study were attending elementary school (68.3%), in line with their age. Education affects a child's quality of life, including understanding their illness and managing symptoms like fatigue (Wahl et al., 2019; Weaver et al., 2020). However, at this age, children still rely on adult support to manage their condition (Nguyen et al., 2019). In terms of treatment duration, more than half of the respondents (53.7%) had been undergoing chemotherapy for less than a year. This initial phase of chemotherapy is usually more aggressive and often accompanied by acute side effects such as nausea, vomiting, and fatigue (Lestari et al., 2022). Children undergoing longer treatment (>1 year) face more complex physical and psychological challenges, such as anxiety, cognitive disturbances, and even depression (Setyawan et al., 2021; Harsono et al., 2023). Most of the respondents were in the maintenance chemotherapy phase, which is the final phase aimed at destroying remaining cancer cells (Deswita et al., 2023). Although it is an advanced phase, side effects such as fatigue and sleep disturbances are still experienced, especially due to the use of dexamethasone (Steur et al., 2020). The medications used in this phase are non-selective, affecting normal cells as well, including those in the digestive tract, which impacts the comfort and quality of life of children (Wong et al., 2021). In addition to the physical effects, children in this phase also face psychosocial challenges such as social isolation and concerns about their future, which overall decrease their quality of life (Hendriks et al., 2021).



Overview of Fatigue in Children

Fatigue is a condition that encompasses both physical and emotional exhaustion, characterized by feelings of helplessness and reduced energy for activities. Children undergoing cancer treatment often experience moderate fatigue, with an average fatigue score of 44.0 (Utami, Chodidjah, & Waluyanti, 2020). This fatigue is known as Cancer-Related Fatigue (CRF), which is caused by the cancer itself and its treatments. Pathophysiologically, CRF is associated with an increase in pro-inflammatory cytokines such as TNF- α , IL-6, and IL-1, which affect energy regulation, sleep, and mood (American Cancer Society, 2022). Approximately 78–80% of cancer patients experience fatigue (National Cancer Institute, 2022). Factors contributing to fatigue in chemotherapy patients include anemia, chronic pain, stress, depression, lack of rest, and insufficient nutrition. This fatigue often does not improve even after rest and can lead to functional impairment and intolerance to physical activity (Deswita et al., 2023). According to Deswita et al. (2023), fatigue is divided into physiological and psychological fatigue. Physiological fatigue arises from dysfunction in the body's systems, while psychological fatigue is triggered by mental and environmental factors that cause emotional stress and mental exhaustion.

Overview of Children's Quality of Life

Analysis of the Questionnaire Based on the PedsQL™ 4.0 Generic Core Scales: Physical, Emotional, Social, and School Functions. The analysis of the questionnaire based on the PedsQL™ 4.0 Generic Core Scales shows that children with cancer generally have a better quality of life in the social functioning domain, with an average score of 12.0. This is in line with the research conducted by Nurhidayah, Hendrawati, Mediani, and Adistie (2022), which found that social function was better compared to other functions. Similarly, research by Ji et al. (2020) in China revealed that the quality of life in the social domain was better than in other domains. This study indicates that in the social function domain, such as playing and socializing with peers, children generally do not experience significant barriers. However, the quality of life also showed lower average scores in the emotional and school functions, with average scores of 14.1 and 12.4, respectively. This is consistent with the study by Nurhidayah et al. (2022), which found that emotional function had the lowest average score. This indicates that children with cancer complain of feeling worried about their health, being easily irritated and sad, and in the school function domain, children experience a decline in quality of life due to the illness, which makes it difficult for them to concentrate in school. Children also sometimes have to miss school due to treatment or hospital visits. Based on the existing phenomenon and the impact of treatment and the progression of leukemia in children, the quality of life of children is disrupted. This disruption can affect their daily physical functions, such as independence, medication management, medical care, fatigue, mobility, rest and sleep, activities, and discomfort (Kiki, 2019). Children with chronic illnesses are known to have a higher potential for experiencing a decline in their quality of life compared to healthy children. The various pressures they experience affect their psychological development, particularly in relation to the disease they are suffering from, such as the need to take medication, pain, and discomfort with their physical appearance (Dewi, 2019).

Bivariate Analysis

Fatigue in children with cancer encompasses both physical and emotional exhaustion, which is often described as a feeling of helplessness or a decrease in energy to perform daily activities. The primary cause of fatigue in children is the side effects of treatment. Based on measurements using the PedsQL™ Multidimensional Fatigue Scale, the average fatigue score among children was 44.0, indicating a moderate level of fatigue. This finding is consistent with

the study conducted by Utami, Chodidjah, and Waluyanti (2020), which also found that children undergoing chemotherapy experienced moderate levels of fatigue. According to Pouraboli et al. (2019), chemotherapy not only increases children's survival rates but also brings several significant side effects, one of which is fatigue. Analysis of the PedsQL™ 4.0 Generic Core Scales questionnaire showed that the social functioning domain had a better average score (12.0) compared to the emotional (14.1) and school functioning (12.4) domains. This suggests that although children with cancer experience a decline in overall quality of life, they tend to maintain better quality of life in the social domain, despite challenges in emotional and academic aspects. A study by Nurhidayah et al. (2016) also found that children with cancer showed the lowest mean scores in the emotional and school functioning domains, reflecting concerns about their health condition, irritability, and difficulty concentrating in school due to the treatments they must undergo.

CONCLUSION

Based on the results of the study, there is a significant relationship between fatigue and quality of life in children with leukemia undergoing chemotherapy. The majority of children experienced impaired quality of life, particularly in the domain of physical functioning, which showed higher levels of impairment compared to emotional, school, and social functions. These findings indicate that fatigue has a substantial impact on multiple aspects of children's quality of life, with physical function being the most affected.

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