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Fatigue in Pediatric Cancer Patients Undergoing Chemotherapy: A Cross-Sectional Study

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ABSTRACT

Fatigue is one of the most common and significant side effects experienced by children undergoing chemotherapy for cancer. This condition not only affects the child's physical state but also significantly impacts their overall quality of life. However, the assessment of fatigue levels in pediatric patients often remains a low priority in clinical services. This study aimed to describe the level of fatigue among pediatric cancer patients after chemotherapy at the Seruni Polyclinic, Arifin Achmad Regional General Hospital, Riau Province. This was a quantitative study with a cross-sectional design. The sampling technique used was purposive sampling, involving 59 children diagnosed with cancer, having received chemotherapy more than once, aged 1–15 years, and willing to participate in the study. The instrument used was the Fatigue in Pediatric Oncology–Allen (FOA-A) questionnaire, which has been validated (r=0.509–0.884) and tested for reliability (r=0.948). Data were analyzed using univariate analysis and presented in frequency distribution tables. The results showed that most respondents were in the preschool age group (33.9%) and male (52.5%). The most common type of cancer was leukemia (66.1%). A total of 64.4% of respondents had undergone 4–6 cycles of chemotherapy, and 61% had received chemotherapy for ≥6 months. Fatigue levels indicated that 62.7% of respondents experienced fatigue. The majority of pediatric cancer patients post-chemotherapy experienced fatigue. These findings emphasize the importance of regular fatigue assessments and the need for structured nursing interventions to reduce its negative impact on children's quality of life.

INTRODUCTION

Cancer remains one of the leading causes of death worldwide. In 2022, approximately 20 million new cases were reported, with nearly 10 million cancer-related deaths. Over the past five years, cancer has been responsible for about 53 million deaths globally (Ferlay et al., 2021). The World Health Organization (WHO), through its Global Initiative for Childhood Cancer, has targeted a 60% reduction in childhood cancer mortality by 2030. Nevertheless, an estimated 400,000 children die from cancer each year (World Health Organization, 2018).

Asia has recorded the highest incidence of cancer globally, accounting for 10 million cases (49.2%) and 56.1% of total cancer deaths (5.4 million cases) (Ferlay et al., 2021). In Indonesia, according to the 2023 report from the Health Development Policy Agency, there were 877,531 recorded cancer cases, with a significant increase in Riau Province from 1.67% in 2018 (Balitbangkes, 2018) to 20,925 cases in 2023. Nationally, the prevalence of childhood cancer in the 5–14 age group was 0.1%, equivalent to 138.46 cases. In Riau Province, the prevalence of pediatric cancer was also high, reaching 1.67% or approximately 26,778 cases (Badan Kebijakan Pembangunan Kesehatan, 2023). Although the number of childhood cancer cases is lower than in adults, cancer remains one of the leading causes of death among children (Nugraheni et al., 2018).

The most common types of cancer in children include leukemia, lymphoma, brain and spinal cord tumors, retinoblastoma, Wilms tumor, neuroblastoma, rhabdomyosarcoma, and bone cancer. In Indonesia, leukemia and retinoblastoma are the most frequently diagnosed pediatric

cancers (Kurniawan & Pawestri, 2020). Cancer management in children involves a variety of approaches, including surgery, radiotherapy, chemotherapy, and targeted therapy, depending on the type and stage of the cancer (Arniyanti, 2020). Among these, chemotherapy is the primary treatment used to inhibit the spread of cancer cells. However, chemotherapy is cytotoxic not only to cancer cells but also to healthy cells, resulting in various side effects such as hair loss, nausea, vomiting, anorexia, sleep disturbances, and fatigue (Ramdaniati et al., 2022).

Cancer-related fatigue (CRF) is one of the most common and distressing side effects of cancer treatment. CRF can occur during and after treatment and is characterized by a persistent and subjective sense of tiredness that is not relieved by rest, affecting daily activities (Anggraeni et al., 2022). A study by Ho et al. (2019) found that 46.4% of children with cancer experienced fatigue every day for an entire week. Meanwhile, Silva et al. (2016) reported that the prevalence of fatigue in cancer patients undergoing chemotherapy ranges from 70% to 100%. Fabi et al. (2020 also noted that 65% of cancer patients experience fatigue, with 40% at the diagnosis phase, 80–90% during chemotherapy or radiotherapy, and 12–37% during immunotherapy.

Arifin Achmad Regional General Hospital in Riau Province is a class B teaching hospital with an integrated cancer center, including pediatric oncology services. This facility provides comprehensive care for pediatric cancer patients, including services at the Seruni Polyclinic. Based on interviews with healthcare workers at the Seruni Polyclinic, it was found that children undergoing chemotherapy often experience a range of complex issues, one of which is fatigue. However, systematic assessment of fatigue levels in pediatric cancer patients has not been a clinical priority, with healthcare workers tending to focus more on physical symptoms such as nausea, vomiting, and pain.

Given the significance of fatigue as a symptom that significantly affects the quality of life in pediatric patients and its relative neglect in clinical practice, this study aims to explore the level of fatigue among pediatric cancer patients post-chemotherapy at the Seruni Polyclinic, Arifin Achmad Regional General Hospital, Riau Province.

METHOD

This study was a quantitative research using a descriptive cross-sectional design. It aimed to describe the level of fatigue experienced by pediatric cancer patients after undergoing chemotherapy. The study was conducted at the Seruni Polyclinic, Arifin Achmad Regional General Hospital, Riau Province, from August to December 2024.

The sampling technique used was purposive sampling, which involves selecting participants based on specific inclusion criteria. This technique is appropriate for quantitative studies that do not aim for broad generalization. Out of a total population of 141 children, 59 respondents met the inclusion criteria and agreed to participate in the study. The inclusion criteria were: children diagnosed with cancer, having received chemotherapy more than once, aged 1–15 years, and willing to participate in the study.

The instrument used in this study was the Fatigue in Pediatric Oncology – Allen (FOA-A) questionnaire, specifically designed to measure fatigue levels in children with cancer (Pelangi & Allenidekania, 2021). The FOA-A questionnaire was previously tested for validity and reliability on 30 children undergoing chemotherapy, yielding validity coefficients ranging from r=0.509 to r=0.884 and a reliability coefficient of r = 0.948, indicating a high level of internal consistency.

Data collection was carried out through direct interviews with respondents to guide the completion of the questionnaire, ensuring the accuracy and accountability of the collected data. The data were analyzed using univariate analysis to describe the distribution and characteristics of each research variable descriptively.

This study received ethical approval from the Health Research Ethics Committee of Arifin Achmad Regional General Hospital, Riau Province, under ethical clearance number 052/IKESPN/KEPK/XII/2024, dated December 19, 2024. Prior to data collection, researchers explained the study's objectives and procedures to the parents or guardians of the children. They obtained written informed consent as a form of voluntary participation agreement.

RESULTS

Table 1. Frequency distribution of respondents' demographic characteristics

Variable	Category	f	%
Ages	Toddler	8	13.6
	Preschool	20	33.9
	School Age	18	30.5
	Adolescent	13	22.0
Gender	Male	31	52.5
	Female	28	47.5
Type of cancer	Leukemia	39	66.1
	Lymphoma	14	23.7
	Others	6	10.1
Type of chemotherapy drug	Vincristine	28	47.5
	Cyclophosphamide (CPA)	11	18.6
	Others	20	33.9
Number of chemotherapy cycles	2–3 cycles	21	35.6
	4–6 cycles	38	64.4
Duration of chemotherapy	≤6 months	23	39.0
	≥6 months	36	61.0

As presented in Table 1, the most significant proportion of respondents was preschool-aged children (33.9%). Male respondents made up 52.5% of the sample, and leukemia was the most prevalent cancer type (66.1%). Vincristine emerged as the most commonly used chemotherapy drug (47.5%), and the majority of respondents (64.4%) had completed 4–6 chemotherapy cycles. In terms of treatment duration, most children had received chemotherapy for ≥6 months (61%) had received chemotherapy for six months or longer.

Table 2. Frequency distribution of respondents based on fatigue level

Fatigue Level	f	%
No fatigue	22	37.3
Fatigue	37	62.7

According to Table 2, out of 59 pediatric cancer patients who had undergone chemotherapy, the majority of children (62.7%) were found to experience fatigue.

DISCUSSION

The findings of this study revealed that the majority of respondents were in the preschool age group (3–5 years), comprising 20 children (33.9%). This is consistent with a study by Victoryna et al. (2024), which reported that cancer predominantly occurred in preschool-aged children (72.9%). Similarly, research by Fatikasari et al. (2018) indicated that preschool children have a higher cancer prevalence compared to other age groups. Sari et al. (2023) also found that most children with cancer were in the preschool age category. These findings suggest that preschool age is a particularly vulnerable developmental phase for the onset of cancer, possibly due to factors such as immune system immaturity, genetic predisposition, and early life environmental exposures.

In terms of gender, most respondents were male (52.5%, or 31 children). This result is aligned with several previous studies that have shown a higher proportion of childhood cancer cases among boys (Pelangi & Allenidekania, 2021), also found that most pediatric cancer patients were male. Likewise, Kamilah et al. (2023) and Fetriyah (2020) reported that more than half of the children diagnosed with cancer were male. A study by A. S. Ratnawati et al. (2024) reinforced this trend, indicating that the highest proportion of pediatric cancer patients was boys. These gender differences are believed to be associated with biological factors originating from the prenatal period, such as differences in birth weight, height, and chromosomal methylation

patterns between males and females. Such factors are thought to shape a biological environment that increases male susceptibility to certain childhood cancers (Williams et al., 2021).

Regarding the type of cancer, leukemia was the most commonly diagnosed among respondents, with 39 children (66.1%). This finding is in line with Ambrella et al. (2021), who reported that most children in their study were diagnosed with leukemia. Similar results were reported by Hasni et al. (2022), who also found that leukemia was the predominant type of cancer in pediatric patients. Heny Purwati et al. (2023) confirmed that leukemia is the most prevalent form of cancer among children, surpassing other types such as lymphoma, sarcoma, and solid tumors. According to Steur et al. (2020), leukemia is one of the most frequently occurring cancers in children and is widely recognized as a common pediatric malignancy. The high prevalence of leukemia in children may be linked to genetic predispositions, environmental exposures, and immunological factors affecting hematopoietic development in the bone marrow.

The study also found that the most commonly used chemotherapy drug among pediatric cancer patients was Vincristine, administered to 28 respondents (47.5%). This result differs from the findings of Hooke et al. (2015), who reported that nearly half of their pediatric cancer patients received Doxorubicin as the primary chemotherapy agent. However, the current result aligns with Anfhal et al. (2020), who found that more than half of the children in their study received Vincristine, while others were treated with a combination of Methotrexate, Cytarabine, and opioids. Efraim et al. (2022) also reported that Vincristine was the primary chemotherapy drug used in more than half of their respondents, alongside Sitabarin and Methotrexate. Vincristine is widely recognized as a standard chemotherapy agent in pediatric oncology, particularly for treating acute lymphoblastic leukemia (ALL), lymphoma, and neuroblastoma (van de Velde et al., 2017). Its effectiveness lies in its ability to disrupt microtubule formation and inhibit mitosis, thereby preventing cancer cell proliferation. Nevertheless, individual responses to Vincristine may vary due to both genetic and non-genetic factors, including drug metabolism, clinical condition, and drug interactions (Pathak et al., 2023).

This study also showed that most respondents had undergone 4–6 cycles of chemotherapy (64.4%, or 38 children). This finding supports previous research by Fernandes & Andriani (2021 who reported that most pediatric cancer patients received chemotherapy between the fourth and sixth cycles. Similar findings were documented by Manday et al. (2022), indicating that most children in their study underwent chemotherapy during the same cycle range. Chemotherapy is typically administered in cycles, consisting of drug administration periods followed by rest intervals. According to the National Cancer Institute (National Cancer Institute, 2018), the first day of chemotherapy marks the beginning of a cycle, followed by a recovery period lasting several days to weeks before the next cycle begins. The duration from the first day of treatment to the end of the rest period constitutes a complete chemotherapy cycle. Administering chemotherapy in multiple cycles aims to maximize therapeutic effectiveness in destroying cancer cells while allowing healthy cells time to recover. In clinical practice, pediatric chemotherapy is commonly administered in 6 to 8 cycles, depending on cancer type, treatment response, and patient condition (Febriani et al., 2024). Therefore, the majority of respondents being in the 4–6 cycle phase indicates they were in an active treatment stage, making it an appropriate time to assess medium-term treatment effects such as fatigue.

In terms of treatment duration, most children had received chemotherapy for ≥ 6 months (61%, or 36 respondents). This is consistent with Ambrella et al. (2021), who reported that most children underwent chemotherapy for less than one year. Similar results were found by Victoryna et al. (2024), showing that nearly all respondents in their study had received chemotherapy within a period of less than 12 months. Hendrawati et al. (2021 also noted that more than half of the pediatric cancer patients in their research had undergone chemotherapy for less than a year.

Out of the 59 pediatric cancer patients who had undergone chemotherapy, the majority experienced fatigue, totaling 37 children (62.7%). This finding aligns with the study by Victoryna et al. (2024), which also reported that more than half of children with cancer post-chemotherapy experienced fatigue. A similar study, Prisani & Rahayuningsih (2017), found that 60% of children with cancer exhibited fatigue symptoms. Further support for this result was provided by Hendrawati et al. (2021), who found that nearly all pediatric cancer patients in their study experienced fatigue, with many classified as having severe fatigue. (Fujihara et al., 2023) also reported comparable findings, noting that most children showed signs of fatigue following

chemotherapy. In addition to its high prevalence, several studies have indicated that fatigue levels tend to increase in line with the number of chemotherapy cycles received. This observation is supported by Lavdaniti M (2014), who explained that the intensity of fatigue in pediatric cancer patients tends to rise as the number of chemotherapy cycles increases. This is consistent with the present study, where most respondents had undergone 4–6 cycles of chemotherapy, an active treatment phase commonly associated with more severe systemic side effects.

CONCLUSION

Based on the findings of this study conducted among pediatric cancer patients post-chemotherapy at the Seruni Polyclinic of Arifin Achmad Regional General Hospital, Riau Province, it can be concluded that the majority of respondents experienced fatigue, with a prevalence rate of 62.7%. The demographic characteristics revealed that most respondents were preschool-aged, male, and diagnosed with leukemia. Additionally, most had undergone 4–6 cycles of chemotherapy over a period longer than six months, with Vincristine being the most commonly administered chemotherapeutic agent. These findings indicate that fatigue is a significant issue among pediatric cancer patients following chemotherapy and is associated with factors such as age, cancer type, number of chemotherapy cycles, and treatment duration. Therefore, routine assessment of fatigue and comprehensive nursing interventions are essential to mitigate its negative impact on children's quality of life. Psychosocial support and ongoing symptom management strategies should also be implemented as part of a holistic approach to pediatric cancer care.

AUTHOR'S DECLARATION

Authors' contributions and responsibilities

GA: The conception and design of the study, as well as drafting the initial manuscript; **FMAP**: Contributed to data collection, analysis, and interpretation; **VD**: Involved in the literature review and assisted in data validation and presentation; **AA**: Provided critical revisions, supervised the research process, and ensured the final approval of the version to be published; **GA, FMAP, VD, AA:** Read and approved the final manuscript and agreed to be accountable for all aspects of the work.

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Availability of data and materials

All data generated or analyzed during this study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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