

Hemoglobin Level, Stress, Family Support, and Fatigue in Breast Cancer Patients Undergoing Chemotherapy

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Abstract

Chemotherapy is one of the therapeutic modalities for breast cancer patients, but it can cause various side effects, such as fatigue. Several studies have shown that fatigue can be influenced by various factors, including Hemoglobin levels, stress, and social support. Therefore, this study aims to identify the relationship between Hemoglobin levels, stress, and social support with fatigue. A cross-sectional design was used, and the sample population comprised 100 breast cancer patients undergoing chemotherapy. Data were collected using observation sheets, and respondents completed several questionnaires, namely Perceived Stress Scale-10, Multidimensional Scale of Perceived Social Support, and Piper Fatigue Scale-12. The mean age of the respondents was 47.63±8.35 years, with 100% being Muslim. In addition, 64% were married, 40% were junior and senior high school graduates, 55% were employed, and 56% had 2-3 chemotherapy cycles. The mean Hemoglobin level, stress score, social support score, and fatigue score were 11.35 ± 1.1, 19.38 ± 2.8, 76.66 ± 5.2, and 4.68 ± 1.2, respectively. Hemoglobin level was negatively associated with fatigue score ($r = -0.206$; $p = 0.040$), while stress score had a positive association ($r = 0.229$; $p = 0.022$). In addition, social support score was negatively associated with fatigue score ($r = -0.232$; $p = 0.020$). Recommendations: Based on the results, optimizing nursing interventions is essential to improve nutritional intake, as well as introduce various relaxation techniques and approaches to patient's social support.

Keywords: Chemotherapy; Haemoglobin; Social Support; Stress

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1. Introduction

The National Cancer Institute predicts that by 2025, there will be approximately 316,950 women diagnosed with invasive breast cancer, with 59,080 new cases of non-invasive ductal carcinoma in situ (DCIS). Reports have shown that 16% of women with breast cancer are less than 50 years old. In addition, approximately 66% of breast cancer cases are diagnosed at a localized stage when treatment tends to work better. A previous report reported that 42,170 women are expected to die from breast cancer by 2025 (National Cancer Institute & Control and Population Sciences, 2024)

Cancer is a serious problem worldwide and is one of the leading causes of death globally, as well as having a significant impact on health and the economy. According to data from the Global Burden Cancer Observatory (Globocan) in 2022, Indonesia recorded more than 408,661 new cancer cases with 242,099 deaths, the most of which were caused by breast cancer. In the absence of preventive measures, it is estimated that the number

of cancer cases in Indonesia can increase by 63% between 2025 and 2040 (Kemenkes RI, 2024)

An effective approach to treating breast cancer is chemotherapy, which is often the main treatment of choice. The Basic Health Research or Riset Kesehatan Dasar (Riskesdas) in 2018 showed that there were 41,596 cancer cases in Aceh (Kemenkes RI, 2018). Based on the 2023 Indonesian Health Survey (SKI), the prevalence of cancer diagnosed by doctors in Aceh Province was 0.7 per 1,000 residents (0.007%) among 17,271 residents who were weighted samples, with a 95% confidence interval (Kemenkes RI, 2023). Data from Dr. Zainoel Abidin Hospital, Banda Aceh, in 2023, showed that 473 breast cancer patients underwent chemotherapy. Meanwhile, from January to March 2024, 137 patients received chemotherapy.

Several studies have shown that cancer treatment can have a significant impact on patients' lives, in terms of their ability to fulfill family roles, participate in the workforce, and have social interactions. In advanced stages, patients often face

a range of challenges, including physical problems, psychosocial distress, and spiritual issues that can affect their quality of life (Maringka, Wiyono, & Antasionasti, 2020; Viriyasiri et al., 2020).

Chemotherapy suppresses the activity of cancer cells, but it can affect the spinal cord, which is one of the factors causing anemia (National Comprehensive Cancer Network, 2024). The chemotherapy process can impact developing healthy cells, leading to damage to important organs, such as the bone marrow, gastrointestinal tract, and hair follicles. The treatment also has other significant side effects, including fatigue, nausea, weight loss, and decreased immune system. In addition to the physical effects, it can have psychological effects, including stress, anxiety, and depression in patients (Muhrisa, 2021a).

One of the side effects of chemotherapy is fatigue, which has a significant impact on functional ability and quality of life. Breast cancer patients who experience fatigue, depression, or anxiety before diagnosis are more likely to experience fatigue after treatment (Casado, Bustos, de Pedro, Otero & Elías, 2021). A study by Fabi and colleagues (2020) reported that 65% of cancer patients experienced chronic fatigue, with 66.6% reporting severe levels lasting 6 months. In addition, 33.3% also experienced the condition lingering for several years after undergoing chemotherapy.

According to Ayubbana (2020), breast cancer patients undergoing chemotherapy experience a significant decrease in quality of life due to prolonged fatigue, which often leads to a decrease in active participation in various activities. In line with Folorunso and colleagues (2022), survivors reported significantly worse fatigue than the healthy population (24.3% versus 10%; $p = 0.025$). Fatigue also severely impaired the ability to concentrate ($p = 0.040$) and relate to others ($p = 0.002$). The condition was more commonly reported in the morning and evening.

Several factors have been reported to affect the level of fatigue in patients undergoing chemotherapy, including age, race, psychological stress, anemia, body mass index, comorbidities, baseline fatigue level, and hemoglobin levels (Andini, Siswandi, Anggunan, & Setiawati, 2022). Theofilou and Varenos (2024) showed that low levels of social support, individual characteristics, socio-demographic, professional variables, and organizational factors interact and influence the severity of the condition. A study was conducted by Gu and colleagues (2023) on 306 patients, of which 74.8% were diagnosed with cancer-related fatigue (CRF). Among the patients, 94 (41.0%) had mild fatigue, 121 (52.8%) had moderate fatigue, and 14 (6.1%) had severe fatigue. The results showed that an increase in depression score was associated with

an increase in aldosterone levels, which may increase the risk of CRF. Other factors that contribute to increased levels are female gender, anxiety, depression, and high aldosterone levels. Fatigue can also be caused by side effects, such as severe nausea and vomiting, leading to wasted nutrient intake for energy (Romadhona, Woelansari, & Suhariyadi, 2020).

Hemoglobin levels have been shown to be an essential clinical indicator of anemia. Previous studies showed that more than 82% of cancer patients develop anemia after undergoing chemotherapy (Wondimneh et al., 2021). This disorder can result in a decrease in the production of blood cells, including erythrocytes, leukocytes, and platelets. Therefore, chemotherapy can contribute to the occurrence of anemia, leukopenia, neutropenia, and thrombocytopenia (Manoralisa & Hendriyono, 2020).

Low hemoglobin levels can lead to fatigue, as hemoglobin plays an important role in the body's metabolism. Hemoglobin is a protein found in red blood cells and functions to transport oxygen to all parts of the body. Consequently, a decrease in its levels often causes a reduction in the supply of oxygen to the rest of the body, leading to fatigue in cancer patients (Yuliastutik et al., 2023).

Psychological factors, such as anxiety, stress, and depression, can contribute to the onset of fatigue. Depression is one of the significant risk factors for fatigue. In addition, fatigue can also trigger depression, sleep disturbances, anemia, anorexia, and changes in appetite (Utami, Chodidjah & Waluyanti, 2020).

Treatment of patients undergoing chemotherapy not only focuses on medical aspects, but also requires attention to psychosocial factors. In this case, the role of family support is very important and cannot be replaced (Muhrisa, 2021b). Family support creates a conducive atmosphere for patients, helping to cope with fear, anxiety, and stress that may arise during the treatment process. Adequate psychosocial support helps to overcome emotional challenges that arise throughout the treatment process (Katimenta, Nugrahini, Hermanto & Mahmudah, 2024)

In hospitals in Aceh province, there are a large number of breast cancer patients undergoing chemotherapy. However, there is no literature or study that identifies fatigue and the associated variables. Therefore, this study aims to identify Hb levels, stress, social support, and fatigue in breast cancer patients undergoing chemotherapy.

2. Method

This study used a cross-sectional design, and all data were obtained at the same time. The population included all breast cancer patients who undergoing chemotherapy at one of the referral

hospitals in Banda Aceh, Indonesia, from August to October 2024. Determination of the sample was carried out using total sampling. The criteria for respondents were more than 18 years old, not experiencing severe stress, able to cooperate, and not having a history of or experiencing psychiatric disorders.

Instruments used to obtain data were demographic data, stress, social support, and fatigue questionnaires. The demographic data questionnaire identified age, spouse status, last education level, employment status, chemotherapy cycle, and hemoglobin level.

Stress data was obtained using the Perceived Stress Scale (PSS). This questionnaire was translated into Indonesian, consisting of 10 questions that were answered on a 0-4 Likert scale; the minimum total score was 0, and the maximum was 40. A validity test using product-moment with a computer program was conducted on this questionnaire. The final result showed that all question items were valid (r value of all question items >0.400). Furthermore, the results of the reliability test using Cronbach's alpha with a computer program showed reliability, with a Cronbach's alpha of 0.820 (Syarif, Waluyo, Afianti, & Mansyur, 2019).

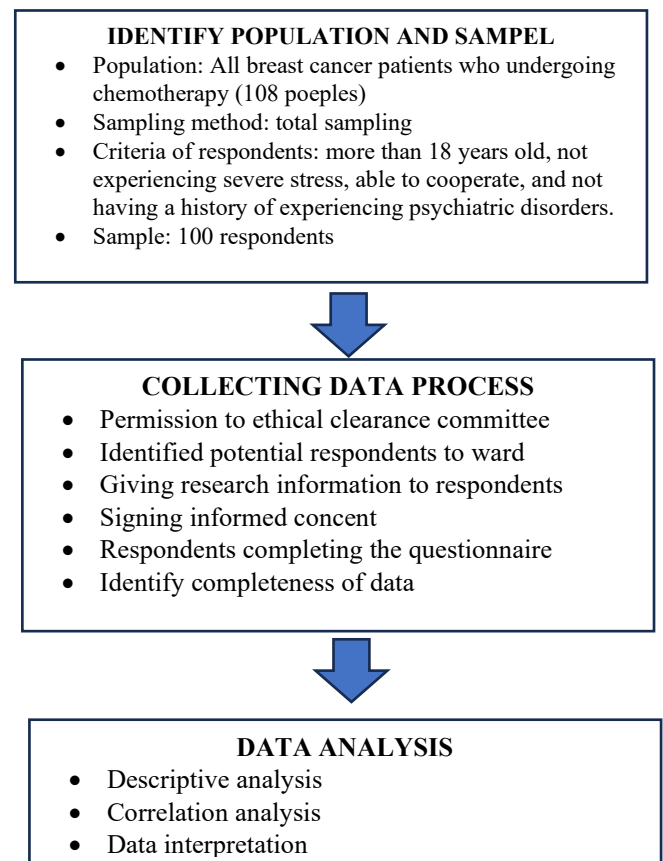
Social support data were obtained using the Multidimensional Scale of Perceived Social Support (MSPSS) developed by Zimet, Dahlem, Zimet, & Farley (1998). MSPSS referred to an instrument with 12 statement items. These 12 items were rated on a 7-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (7). MSPSS measurement results were in a score between 12 to 84, and its instrument was used with cancer patients, which showed a high reliability coefficient of 0.90 (Calderón et al., 2021)

Fatigue data were obtained using the Piper Fatigue Scale-12 (PFS-12) questionnaire. This instrument was a good instrument used to measure fatigue conditions in cancer patients. This questionnaire consisted of 12 questions. The minimum score was zero, while the maximum score was 120. Subsequently, the result was divided by 12, and the score was between 0 to 10. A validity test using Product-Moment with a computer program was also conducted on this questionnaire. The final result showed that all question items were valid (r value of all question items >0.400). The reliability test results using Cronbach's alpha with a computer program showed reliable results, with Cronbach's alpha of 0.880 (Syarif et al., 2019).

Collecting Data Procedures

This began with an application for permission to conduct a study and obtain proof of passing the Health study ethics test from the

committee with number 193/ETIK-RSUDZA/2024. The study teams identified potential respondents who fit the criteria based on data from the chemotherapy unit to become respondents, then explained detailed study information to respondents, including the method and duration of filling out the questionnaire. Respondents who agreed to participate were instructed to sign an informed consent, and completed the questionnaire within 15 to 30 minutes. The study teams identified the completeness of data and respondents' answers, then tabulated and continued data analysis.



Picture 1. Research flowchart

Data Analysis

Data about respondent characteristics were analyzed by simple descriptive analysis, including frequency and percentage. Meanwhile, data on Hemoglobin levels, stress, social support, and fatigue were analyzed to determine the mean, standard deviation, minimum and maximum values, and range. The relationship between Hemoglobin levels, stress, social support, and fatigue was analyzed using Pearson correlation. Furthermore, the strength of correlation in this study showed that score 0.0-0.2 was very weak, 0.2-<0.4 was weak, 0.4-<0.6 was moderate, 0.6-<0.8 was strong, and 0.8-1.00 was very strong (Dahlan, 2020).

3. Results and Discussion

Table 1 showed that the mean age of respondents was 47.63 ± 8.35 years, 100% Muslim, 74% married, 40% junior and senior high school graduates, 55% still working, and chemotherapy cycles 2 to 3 as much as 56%. This was consistent with the study of Harbelubun & Rahmawati (2024) that breast cancer was most prevalent in the age group 31-59 years (77.14%), as well as the majority of breast cancer patients in the study of Salim, Hutahaean, & Sitohang (2024), respondents aged 40 to 49 years, amounting to 44.2%. However, something different was shown in the study of Laisla (2017), that most breast cancer patients were aged 50 to 59 years, 35.7%.

Tabel 1. Respondents Characteristics (n=100)

Characteristics	n (%)	(mean±SD)
Age, year		47.63±8.35
Religion		
Moslem	100 (100)	
Marital status		
Single	4 (4.0)	
Married	74 (74.0)	
Widow	22 (22.0)	
The last education		
Basic school	21 (21.0)	
Junior and Senior school	40 (40.0)	
University education	39 (39.0)	
Occupation		
Employment	55 (55.0)	
Non-employment	45 (45.0)	
Chemotherapy cycles		
2 to 3	56 (56.0)	
4 to 6	44 (44.0)	
Total	100 (100)	

Salim et al. (2024) were also consistent with this study that the majority of breast cancer patients were in the working category (namely, 53.85%). This could be caused by the majority of respondents in this study being of productive age.

Currently, chemotherapy was a method that was widely chosen or recommended as a treatment in cancer patients, this was evidenced by the study of Laisla (2017), that 71.4% of cancer patients chose chemotherapy treatment.

Table 2 showed that the mean Hemoglobin level was 11.35 ± 1.1 g/dL, the minimum Hemoglobin level of respondents was 8 g/dL, and the maximum was 13.5 g/dL, at normal levels for women, which was 12-15 g/dL. The mean stress score was 19.38 ± 2.8 , the minimum respondent score was 13, and the maximum was 28, in the

range of 0-40 questionnaire scores. Furthermore, the mean social support score was 76.66 ± 5.2 , the minimum score was 66, and the maximum was 84, in the range of 12 to 84. The mean fatigue score was 4.68 ± 1.2 , the minimum score of respondents was 2.3, and the maximum was 7.3, in the range of questionnaire scores 0-10.

Fatigue was one of the most common side effects of cancer treatment, and more than 80% of cancer patients experience fatigue while undergoing chemotherapy or radiation therapy (NIH, 2024). The pathophysiology underlying CRF was complex and not fully understood (Dessai, Chakrabarty & Sulochana, 2025). However, it was believed that the main biological mechanism for cancer fatigue was the chronic inflammation or inflammatory process that patients experienced (Vasbinder et al., 2020).

Fatigue experienced by cancer patients undergoing chemotherapy could be caused by damage to healthy cells other than cancer cells due to the chemotherapy process. As a result, the body must try to repair the damage and cause fatigue (Les et al., 2024). Previous studies have shown that some people feel very tired after chemotherapy treatment, while others experienced more severe fatigue during chemotherapy. The fatigue decreased after chemotherapy was over, but the majority did not feel back to normal for a month or more. However, it usually improved before the next treatment (Les et al., 2024; NCCN, 2024; NIH, 2024)

Table 3 showed that the Hemoglobin level was negatively associated with fatigue score, weak strength, and a significant relationship ($r = -0.206$; $p = 0.040$). Stress score was positively associated with fatigue score, weak strength, and a significant relationship ($r = 0.229$; $p = 0.022$). Social support score was negatively associated with fatigue score, weak strength, and a significant relationship ($r = 0.232$; $p = 0.020$).

Table 2. Score of Hemoglobin level, Stress, Social support, and Fatigue (n=100)

Variable	Mean ± SD	Min-Max	Standard of Questionnaire
Hemoglobin Level (g/dL)	11.35 ± 1.1	8-13.5	
Stress	19.38 ± 2.8	13-28	0-40
Social support	76.66 ± 5.2	66-84	12-84
Fatigue	4.68 ± 1.2	2.3-7.3	0-10

The results of this study showed that Hemoglobin (Hb) levels were negatively associated with fatigue scores, weak strength, and relationship ($r=-0.206$; $p=0.040$). This suggested that the higher

the Hemoglobin level, the less fatigue felt by cancer patients. Similarly, a previous study showed that there was a highly significant, but mild correlation between low baseline Hemoglobin levels and patients' perception of high fatigue (Gascón et al., 2013). In pediatric cancer patients, there was an association between anemia and fatigue (Purwati et al., 2023).

Table 3. Correlation analysis of Hemoglobin level, Stress, Social support, and Fatigue (n=100)

Variabel	r	p-value
Hemoglobin Level	-0.206	0.040
Stress	0.229	0.022
Social support	-0.233	0.020

Hemoglobin referred to a protein found in red blood cells that carried oxygen from the lungs to all other organs of the body (WHO, 2025). Low hemoglobin levels or anemia in cancer patients were often caused by inflammation, which inhibited the production of red blood cells, as well as the administration of treatment agents to destroy cancer cells, which could simultaneously cause a decrease in the production of new blood cells in the bone marrow (ACS, 2025). When the hemoglobin count was too low, there could be a decrease in the blood's capacity to carry oxygen to the body's tissues, leading to symptoms such as fatigue, weakness, dizziness, and shortness of breath (WHO, 2025).

The strength of the association in this study appeared weak, as Hemoglobin levels were generally corrected before chemotherapy was initiated, so the average patient's Hemoglobin was in the near-normal to normal range. In 5 clinical trials of cancer patients who did and did not undergo chemotherapy, improvements in Hemoglobin were associated with significant improvements in fatigue reduction (Dessai, Chakrabarty, & Sulochana, 2025). In a previous study, it was showed that patients with minimum Hemoglobin (<8 g/dL) who were hospitalized had higher levels of fatigue, compared to patients with hemoglobin levels within the normal range (Prochaska, Newcomb, Block, Park, & Meltzer, 2017).

The American Cancer Society and National Cancer Institute showed that, in addition to the condition of low hemoglobin, stress was also a factor that was closely related to fatigue (ACS, 2025; NIH, 2024). Furthermore, this study showed that stress scores were positively associated with fatigue scores, weak strength, and relationship ($r = -0.229$; $p = 0.022$), suggesting that the higher the stress score, the more severe the fatigue felt. This was consistent with previous study, that higher perceived stress is associated with higher severity of fatigue in cancer patients (Ho et al., 2015).

Activation of the stress system led to behavioral and peripheral changes, including decreased immunity (Mbiydzennyuy & Qulu, 2024; Weber & O'Brien, 2017). Furthermore, stress-related psychosocial factors, including stress-prone personality, appeared to be associated with higher cancer incidence, poorer survival, and higher mortality in cancer patients, including fatigue (Weber & O'Brien, 2017).

An important effort in treating fatigue was social support (Kyriazidou et al., 2022). This study also showed that social support scores were negatively associated with fatigue scores, weak strength, and a significant relationship, at score $r = -0.232$ and $p = 0.020$. Furthermore, this suggested that the greater the social support, the less fatigue was felt. This was consistent with a previous study that there was a negative relationship between perceived social support and fatigue in cancer patients undergoing chemotherapy, but this relationship was not significant, with a score of $r = -0.24$ and $p = 0.009$ (Mardanian-Dehkordi & Kahangi, 2018). A slightly different thing was shown in previous studies, that there was no relationship between social support and physical fatigue, but social support was closely related to mental or psychological fatigue in cancer patients (Sørensen, Schjølberg, Småstuen, & Utne, 2020).

Social support was a complex and multidimensional structure, which referred to several types of support that people receive from others and includes emotional, functional, and informational support. Emotional support implied that someone will love and care for the patient. Meanwhile, functional support implied tangible support, which was provided to a person by others, such as home support, economic assistance, and informational support (Fakhri, Pakseresht, Haghdoost, Talaiezhadeh, & Rashidizad, 2012).

Fatigue was one of the indicators of low quality of life. Social support had a major effect on quality of life (physical and psychological well-being). Breast cancer patients who had high social support always think positively and have high motivation to fight their disease, which had an impact on increasing the patient's life expectancy and recovery (Anggraini, 2021; Asis, Anisa, & Isa, 2021).

4. Conclusions and Suggestions

In conclusion, Hemoglobin level is negatively associated with fatigue score, weak strength, and a significant relationship. Stress score is positively associated with fatigue score, weak strength, and relationship. Social support score is negatively associated with fatigue score, weak strength, and relationship. The higher the stress score, the more severe the fatigue is, while the

higher the Hb level and family support, the less severe the fatigue is.

Recommendations for health care services include optimization of nursing interventions to improve nutritional intake, several relaxation techniques, and approaches to social support providers. Recommendations for future studies are exploring fatigue with more specific variables, such as partner support, type of activity, and daily nutritional intake.

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