Path Analysis of the Relationship between Nutritional Status, Maternal Knowledge, Dietary Compliance and Health-Related Quality of Life in Children with Acute Lymphoblastic Leukemia

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ABSTRACT

Background: Acute Lymphoblastic Leukemia (ALL) is the most common type of blood cancer in children. Treatment for ALL may affect the patient's quality of life. Factors such as nutritional status, maternal knowledge of nutrition, and dietary compliance play a role in determining the quality of life of children with ALL. This study aims to analyze the relationship between nutritional status, maternal knowledge, and dietary compliance with health-related quality of life (HRQoL) in children with ALL.

Subjects and Method: This study used a cross-sectional design with a sample of 52 children with ALL at the Pediatric Hematology Clinic of Dr. Moewardi Surakarta Hospital in October-November 2024. The independent variables were nutritional status, maternal knowledge, and dietary compliance, while the dependent variable was HRQoL. Data were collected using anthropometric instruments and questionnaires, then analyzed with single logistic regression and path analysis.

Results: Single logistic regression analysis showed that nutritional status (OR= 4.60; 95% CI= 1.311 to 16.139; p = 0.017) and dietary compliance (OR= 4.82; 95% CI= 1.39 to 16.78; p= 0.013) were significantly associated with HRQoL. Maternal knowledge had no significant effect (OR= 1.88; 95% CI = 0.35 to 10.18; p = 0.467). Path analysis showed that nutritional status, dietary compliance, and body mass index had a direct positive association with the child's quality of life. The path analysis model showed a good fit with the data (goodness of fit p = 0.594).

Conclusion: Nutritional status and dietary compliance are major factors in improving the quality of life of children with ALL. Although maternal knowledge does not have a direct effect, the mother's role remains important through improving the child's dietary compliance. Multidisciplinary interventions that integrate nutrition education and family support are needed to enhance HRQoL in pediatric patients with ALL.

Keywords: acute lymphoblastic leukemia, cancer, nutritional status, quality of life

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BACKGROUND

Acute Lymphoblastic Leukemia (LLA) is the most common type of blood cancer in children, contributing to about 75-80% of all pediatric cancer cases (Ding et al., 2025). The incidence of ALL in children and adolescents globally in 2021 was approximately 2.5 cases per 100,000 children, with an increasing trend of approximately 1.3% per year since 1990. The prevalence of ALL reached about 15 cases per 100,000 children. The mortality rate of pediatric ALL in 2021 was about 1.2 deaths per 100,000 children (Wang, et al., 2025). In Indonesia, the incidence of pediatric ALL is estimated to be around 4.32 per 100,000 children, while the mortality rate ranges from 0.44 to 5.3 per 100,000 children (Garniasih et al., 2022).

The treatment of ALL requires a holistic approach, which includes chemotherapy, nutrition, and psychological support (Joffe and Ladas, 2020). These treatments often cause various side effects that affect the physical, psychological, and social aspects of children, which can impact their quality of life (Fardell et al., 2017). Assessment of the quality of life of pediatric leukemia patients is important to determine the impact of the disease and predict the effectiveness of treatment (Lewandowska et al., 2020).

Nutrition plays a crucial role in the treatment and quality of life of children with ALL. One factor that affects the effectiveness of treatment is the nutritional status of the patient, which is related to the body's ability to tolerate therapy, accelerate recovery, and reduce the risk of infection (Pedretti et al., 2023). Side effects of treatment on the gastrointestinal system, such as nausea and vomiting, can affect a child's diet. These conditions often lead to decreased appetite, dehydration, and difficulty in ingesting nutritious foods, which in turn can worsen the child's nutritional status (Tanrıverdi et al., 2020). Maternal knowledge about nutrition and adherence to recommended dietary patterns have an impact on children's nutritional intake. Mothers who have good knowledge about managing their child's nutrition and the importance of following the diet recommended by medical personnel can help maintain their child's nutritional status. Good nutritional status can improve their HRQoL during treatment (Said et al., 2020).

The aim of this study was to analyze the pathways of association between mothers' knowledge of nutritional care, the level of adherence to diet, children's nutritional status, and their impact on the HRQoL of children with ALL. With better insight into these associations, it is believed that more effective strategies can be developed to improve the quality of life of children with ALL through interventions that target the mother's role in the management of the child's diet and health.

SUBJECTS AND METHOD

1. Study Design
This study used a cross-sectional design conducted at the Pediatric Hematology Clinic of RSUD dr. Moewardi Surakarta during the period from October to November 2024.

2. Population and Subject
The population of this study consisted of pediatric patients who visited the Pediatric Hematology Clinic at Dr. Moewardi Surakarta Hospital. A consecutive sampling technique was used for sampling. The

subjects included 52 patients who met the inclusion and exclusion criteria.

3. Study Variable

The independent variables in this study were nutritional status, maternal knowledge, and dietary compliance. The dependent variable was the health-related quality of life (HRQoL) of pediatric patients with ALL.

4. Operational Definition of Variable

Nutritional status refers to the biochemical, structural, and functional condition of the body, which is influenced by the level of energy and nutrient intake as well as factors affecting absorption and metabolism. Maternal knowledge of nutrition refers to the intellectual aspect that reflects understanding of nutrition science, types of nutrients, and the relationship between nutrition and health. Dietary compliance refers to the behavior of individuals in following dietary recommendations provided by healthcare professionals according to their nutritional needs. Health-related quality of life (HRQoL) is a multidimensional parameter that includes physical, social, functional, and emotional health, all of which can influence the patient's condition.

5. Study Instrument

This study used instruments including a body weight scale, stadiometer, WHO BMI-for-age curves, a parental nutrition knowledge questionnaire for parents of children with cancer, a dietary compliance questionnaire for pediatric cancer patients, and the PedsQL Cancer Module 3.0 questionnaire.

6. Data Analysis

Univariate analysis was used to describe the frequency distribution of respondent characteristics. Bivariate analysis was performed using single logistic regression to examine the relationship between independent and dependent variables. Multivariate analysis was conducted using path analysis to test the relationships among the independent variables and the dependent variable.

7. Reseach Ethics

Ethical approval for this study was obtained from the Research Ethics Committee at RSUD dr. Moewardi Surakarta, Indonesia, with approval number 2.196/IX/HREC/-2024, on September 6, 2024.

RESULTS

1. Sample Characteristics

Table 1 shows that the majority of subjects in this study are male and aged between 5 and 11 years. Most of the subjects are enrolled in elementary school. The majority of mothers fall within the age range of 31 to 40 years, with high school being the most common level of education. In terms of occupation, the majority of mothers are housewives. Table 2 presents the numerical data for the variables in this study.

Table 1. Subject characteristics (categorical data)

Characteristic	Category	Frequency (n)	Percentage (%)
Age	2 - 3 years	3	5.8
	3 - 5 years	9	17.3
	5 - 11 years	31	59.6
	12 - 18 years	9	17.3
Gender	Male	27	51.9
	Female	25	48.1
Education	None	15	28.8
	Kindergarten	10	19.2
	Elementary school	21	40.4
	Junior High School	2	3.8
	Senior High School	3	5.8
	Dropped out	1	1.9

Characteristic	Category	Frequency (n)	Percentage (%)
Mothers's age	21 – 30 years	16	30.8
	31 – 40 years	22	42.3
	41 – 50 years	14	26.9
Mother's education	Elementary school	8	15.4
	Junior High School	17	32.7
	Senior High School	24	46.2
	University	3	5.8
Mother's occupation	Entrepreneur	6	11.5
	Private employee	3	5,8
	Teacher	1	1.9
	Farmer	2	3.8
	Housewife	40	76.9

Table 2. Subject characteristics (data continuous)

Subject Characteristic	N	Mean	SD	Min	Max
Age	52	7.40	3.74	2	18
Weight	52	27.45	14.18	8.5	66.1
Height	52	116.22	28.96	13.1	164
BMI	52	17.48	4.03	12.42	29.8
Maternal knowledge score	52	71.84	12.36	42.86	100
Dietary compliance score	52	31.54	1.99	27	35
Quality of life score	52	0.52	0.50	50.96	100

2. Bivariate Analysis

The results of the simple logistic regression analysis presented in Table 3 show that subjects with good nutritional status have 4.60 times higher odds of having a good quality of life compared to individuals with poor nutritional status OR = 4.60; 95% CI = 1.31 to 16.14; p = 0.017. Additionally, dietary compliance also plays a significant role in improving quality of life, with subjects who adhere to the diet having 4.8 times higher odds of having a good quality of life compared to those who do not comply OR = 4.82; 95% CI= 1.39 to 16.78; p= 0.013. Meanwhile, maternal knowledge did not show a significant relationship with quality of life OR = 1.88; 95% CI = 0.35 to 10.18; p= 0.467.

Tabel 3. Result of single logistic regression analysis of nutritional status, maternal knowledge, dietary compliance and health-related quality of life in children with acute lymphoblastic leukemia

Independent Variable	OR	95% CI		p
		Lower limit	Upper limit	
Nutritional Status	4.60	1.31	16.14	0.017
Maternal Knowledge	1.88	0.35	10.18	0.467
Dietary Compliance	4.82	1.39	16.78	0.013

3. Multivariate analysis

Figure 1 shows the path diagram illustrating the relationships between maternal knowledge, dietary compliance, body mass index BMI, nutritional status, and HRQoL in children with leukemia. The diagram indicates that the quality of life in children with ALL is directly influenced by dietary compliance, BMI, and nutritional status. Dietary compliance is positively associated

with improved quality of life in children with ALL. BMI is positively related to the improvement of quality of life in children with leukemia. Similarly, nutritional status is positively associated with improved quality of life in children with leukemia. The path diagram shows a good model fit, with goodness of fit indices: chi-square p = 0.594 >0.50, RMSEA= 0.001 <0.08, CFI= 1.00 >0.90, TLI= 1.04 >0.90, SRMR= 0.068 <0.08, and CD= 68.5%.
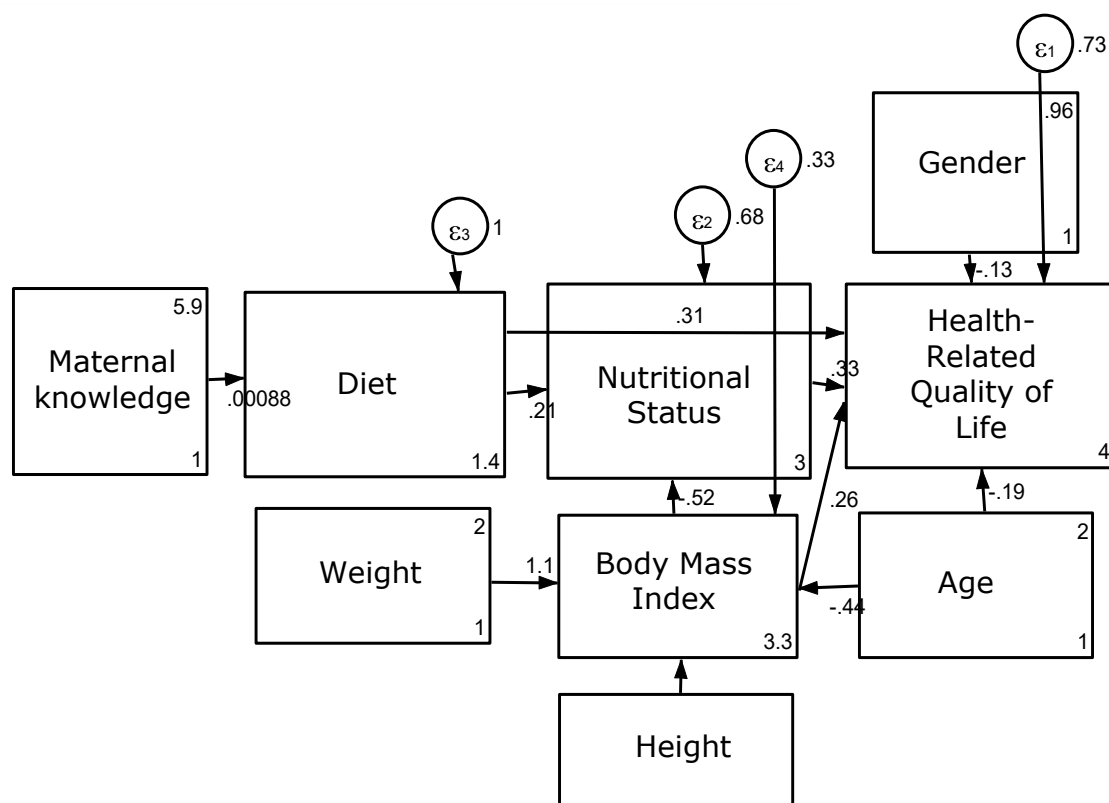

Figure 1. PATH diagram of the relationship between diet, body mass index, and nutritional status with health-related quality of life in children with acute lymphoblastic

Table 4 presents the results of path analysis regarding the relationships between maternal knowledge, children's dietary compliance, body mass index BMI, nutritional status, and health-related quality of life in children with ALL. The path analysis shows a positive relationship between dietary compliance and quality of life. The higher the dietary compliance, the better the quality of life in children with leukemia b= 0.31; 95% CI = 0.08 to 0.54; p = 0.009. The table also shows a positive relationship between BMI and quality of life. The higher

the BMI, the better the quality of life in children with leukemia b = 0.26; 95% CI = -0.05 to 0.57; p = 0.098. Nutritional status is positively associated with quality of life in leukemia. Children with leukemia who have good nutritional status have better quality of life than those with poor nutritional status b = 0.33; 95% CI = 0.06 to 0.61; p = 0.018. The table also shows that dietary compliance is positively related to nutritional status. Children with leukemia who comply with the diet have better nutritional status than those who do not comply b = 0.21; 95% CI = -0.01

to 0.43; p = 0.058.

Table 4 also indicates a negative relationship between age and BMI. As the age of children with leukemia increases, their BMI decreases b = -0.44; 95% CI = -0.72 to -0.16; p = 0.002. The table also shows a positive relationship between maternal knowledge and dietary compliance. The higher the maternal knowledge, the better the dietary compliance b = 0.01; 95% CI = -0.27 to 0.27; p = 0.095.

Table 4. Path analysis of the relationship between diet, body mass index, and nutritional status with health-related quality of life in children with acute lymphoblastic leukemia

Dependent Variable		Independent Variable	b	95% CI		p
				lower	upper	
Direct effects						
Quality of Life	←	Nutritional status	0.33	0.06	0.61	0.018
	←	Dietary compliance	0.31	0.08	0.54	0.009
	←	BMI	0.26	-0.05	0.57	0.098
	←	Age	-0.19	-0.45	0.06	0.142
	←	Gender	-0.13	-0.36	0.11	0.283
Indirect effect						
Nutritional Status	←	Dietary compliance	0.21	-0.01	0.43	0.058
	←	BMI	-0.52	-0.71	-0.33	<0.001
BMI	←	Age	-0.44	-0.72	-0.16	0.002
	←	Weight	1.15	0.97	1.32	<0.001
	←	Height	-0.06	-0.27	0.15	0.562
Dietary Compliance	←	Maternal knowledge	0.01	-0.27	0.27	0.095

N observation = 52
Log likelihood = -1185.682
Goodness of Fit: Chi Square p= 0.594
RMSEA < 0.001
CFI= 1.00
TFI= 1.04
SRMR= 0.068
CD = 68.5%

DISCUSSION

The results of this study confirm that nutritional status is a key determinant that significantly contributes to the quality of life in children with ALL. These findings are consistent with the research conducted by Lippi et al. (2024), which emphasizes that optimal nutritional status plays a crucial role in supporting tolerance to chemotherapy regimens and accelerating the healing process, thus directly improving clinical outcomes and patient well-being. Good nutritional status not only supports the body's physiological functions but also directly contributes to improving the patient's quality of life through better physical condition, emotional stability, and enhanced social interactions Diakatou and Vassilakou, 2020.

Dietary compliance also shows a significant positive relationship with the patients' quality of life. This indicates that implementing a diet that aligns with clinical recommendations is crucial in minimizing complications related to malnutrition during cancer treatment (Arends et al.,

2017). This is consistent with the principles of nutrition management in pediatric oncology patients, which emphasize the active role of the family, particularly the mother, in ensuring adequate and consistent nutrient intake to maintain metabolic homeostasis and prevent nutritional deficiencies that could worsen clinical prognosis Barr and Ladas (2020). These findings underscore that interventions such as nutrition education not only enhance knowledge but also improve parents' practical ability to effectively manage their child's diet (Murimi et al., 2018).

The results of the study show that maternal knowledge is positively associated with dietary compliance. However, the direct relationship between maternal knowledge and the children's quality of life was not statistically significant. This suggests that an increase in knowledge does not automatically lead to behavioral changes without supporting factors such as economic factors, motivation, and social support Greaney et al. (2018). Therefore, comprehensive intervention strategies should include psychosocial aspects and family empowerment to create a conducive environment for the consistent and sustainable implementation of dietary recommendations (Black et al., 2017). This is in line with Argyle (2017) theory, which emphasizes that social interaction is crucial in shaping and modifying individual behavior.

In the path analysis, in addition to the main independent variables, namely nutritional status, maternal knowledge, and dietary compliance, additional variables such as Body Mass Index BMI, age, sex, weight, and height were also included. BMI was used as a quantitative indicator of nutritional status, providing a more detailed view of the patient's physical condition. Age and sex were included to control for demographic effects that could potentially influence quality of life and nutritional status. Weight and height were analyzed as important components closely related to BMI and nutritional status. This approach aims to obtain a more accurate and comprehensive model of the relationships between factors affecting the quality of life in children with ALL (Kline, 2016).

Overall, the path analysis model used in this study demonstrates that nutritional status, dietary compliance, and body mass index have a direct contribution to the quality of life in children with ALL, reflecting the complex relationship between biological and behavioral factors in the context of managing chronic disease. The practical implication of these findings is the need for the development of multidisciplinary intervention programs that integrate nutrition education, psychosocial support, and community assistance to optimize therapeutic outcomes and improve the quality of life for patients.

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CONFLICT OF INTEREST
There is no conflict of interest in this study.

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