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Case Report

Nutritional Care Management of a Pediatric Patient with Stage V Chronic Kidney Disease on Hemodialysis Complicated by Hypertension and Pulmonary Edema with a Differential Diagnosis of Rheumatic Heart Disease

Manajemen Asuhan Gizi pada Pasien Anak dengan Penyakit Ginjal Kronis Stadium V yang Menjalani Hemodialisis dengan Komplikasi Hipertensi dan Edema Paru serta Diagnosis Banding Penyakit Jantung Rematik

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Abstract: *Chronic Kidney Disease (CKD) stage V in pediatric patients requires renal replacement therapy such as hemodialysis and is often accompanied by complications including hypertension and cardiovascular disorders, such as suspected rheumatic heart disease (RHD). These conditions increase the risk of fluid overload, pulmonary edema, and nutritional problems, thus requiring comprehensive nutritional management. This study used a descriptive* observational single-case report developed *at Dr. Moewardi General Hospital, Surakarta. The subject was selected using purposive sampling based on the risk of malnutrition using the STRONG-kids screening form. Data were collected through interviews, medical records, anthropometric measurements, biochemical and clinical assessments, and a 24-hour food recall. Nutritional care was carried out using the standardized Nutrition Care Process, including assessment, diagnosis, intervention, education, and monitoring for three days. The subject was a 13-year-old pediatric patient with CKD undergoing hemodialysis, presenting with edema, hypertension, and suspected RHD. Dietary intake was inadequate (<70%). Anthropometric assessment based on Mid-Upper Arm Circumference (MUAC) indicated normal nutritional status despite the presence of edema. Biochemical examination showed anemia and increased creatinine and urea levels. Nutritional intervention showed an increasing trend in intake over three days, although energy and carbohydrate intake remained deficient. Clinical parameters, including blood pressure and respiratory rate, showed improvement, along with decreased creatinine and urea levels. Nutritional therapy in the form of a hemodialysis diet and low-sodium diet contributed to improved intake, fluid balance, and clinical outcomes. Sodium restriction played an important role in controlling blood pressure and preventing fluid overload, including the risk of pulmonary edema. Integrated nutritional management combined with hemodialysis improved intake, clinical condition, and biochemical parameters in pediatric CKD patients with hypertension and suspected RHD.*

Key word: *Chronic Kidney Disease, Pediatric Nutrition, Nutritional Management, Rheumatic Heart Disease*

1. INTRODUCTION

Chronic Kidney Disease (CKD) is a progressive and irreversible impairment of kidney function which, at stage V, requires renal replacement therapy such as hemodialysis (HD). In pediatric patients, CKD not only affects organ function but also disrupts growth and development and increases the risk of metabolic and cardiovascular disorders (1). Globally, the prevalence of CKD in children ranges from 18.5 to 58.3 per 1,000,000 children, although national data in Indonesia remain limited. However, the prevalence of CKD among individuals aged ≥15 years reaches 19.3%, indicating a significant burden of disease (2). As the disease progresses, CKD patients often experience various complications, one of which is hypertension. Hypertension can accelerate the decline in kidney function and increase the risk of damage to other target organs (3).. This condition becomes more complex when accompanied by cardiovascular disorders, including suspected rheumatic heart disease (RHD), which is still commonly found in children in developing countries. RHD can cause damage to heart valves, leading to hemodynamic disturbances, increased pressure in the pulmonary circulation, and pulmonary congestion and edema (4).

The combination of stage V CKD, hypertension, and RHD can cause fluid and electrolyte imbalance that worsens the patient's clinical condition, including fluid overload and respiratory distress. This condition also affects nutritional status, characterized by decreased intake, increased metabolic demands, and the risk of malnutrition and fatigue. Although various studies have addressed CKD in children and cardiovascular complications separately, reports on the integrated management of pediatric patients with stage V CKD complicated by hypertension and suspected PJR remain limited, particularly in the context of clinical nutritional interventions. Therefore, this case report is important for providing a comprehensive overview of the clinical challenges and the intervention approaches employed. It is hoped that this case will contribute to enriching the scientific evidence regarding multidisciplinary management, particularly the role of nutritional therapy in supporting clinical improvement and quality of life in pediatric patients with complex comorbidities.

2. METHODS

This study is a single-case report developed using the Nutrition Care Process (NCP) framework. The subject of this study was a pediatric patient at risk of malnutrition, identified through screening using the STRONG-kids form. The nutritional care intervention was conducted at Dr. Moewardi General Hospital in Surakarta in May 2023. Data collection was conducted through in-depth interviews and medical record analysis. Nutritional care intervention was carried out comprehensively, beginning with assessment of anthropometric, biochemical, physical, clinical data, and medication history. Dietary intake was assessed using a 24-hour food recall interview. Based on the assessment results, a nutritional diagnosis was established, and an intervention plan was developed. Energy requirements were calculated using the *Schofield formula*, adjusted for the patient's age, sex, and clinical condition, while also considering stress and activity factors. The *Basal Metabolic Rate* (BMR) was calculated using the following equation (5): BMR = (16,25 x Body Weight) + (137,2 x Height) + 515,5. Subsequently, the Total Energy Expenditure (TEE) was estimated as: TEE = BMR x Activity Factors x Stress Factors.

Macronutrient requirements (protein, fat, and carbohydrates) are determined based on the disease condition and dietary recommendations for CKD patients on hemodialysis. Nutritional interventions include setting goals, establishing dietary principles and requirements, and developing a three-day dietary prescription. Monitoring and evaluation were conducted periodically during the intervention period by tracking daily food intake using a 24-hour food recall, as well as assessing changes in clinical condition and the patient's tolerance to the prescribed diet. Additionally, nutrition education was provided to patients and their families as part of the intervention to improve adherence to the diet. This study has considered ethical aspects by obtaining informed consent from patients and/or their guardians prior to the implementation of nutritional care and data collection.

3. RESULTS

In this case study, a 13-year-old pediatric patient was admitted with the chief complaint of dizziness. On initial examination, the patient was fully conscious but appeared weak and had edema in the face and extremities. The patient had been diagnosed with CKD since February 2023 and underwent routine hemodialysis twice a week. Anthropometric assessment in this case is primarily based on Mid-Upper Arm Circumference (MUAC) due to the presence of edema. MUAC is considered a more reliable and objective indicator for evaluating nutritional status in edematous patients, as measurements at this site are minimally affected by fluid accumulation and fluctuations in extracellular fluid volume(6). Laboratory examination showed that hemoglobin, hematocrit, and erythrocyte levels were below normal. This condition may be caused by decreased erythropoietin production and hemodilution due to hypervolemia. Hypoalbuminemia may occur due to protein loss through urine.

Physical examination showed that the patient was weak and had swelling (edema) on the face, hands, and feet. The patient also had high blood pressure (130/90 mmHg) and rapid breathing, reaching 28 breaths per minute. These symptoms of shortness of breath and swelling indicate a severe buildup of fluid in the body. In children with stage V kidney failure, the combination of swelling and shortness of breath strongly supports the suspicion of heart problems caused by Rheumatic Heart Disease (RHD). In this condition, the heart cannot pump blood effectively, causing fluid to back up and collect in the lungs, which leads to severe shortness of breath known as pulmonary edema. Dietary intake based on a 24-hour recall indicated that energy, protein, fat, carbohydrate, sodium, and potassium intake were all in the deficit category (<70%). Monitoring results showed an increasing trend in intake from day one to day three, although energy, carbohydrate, and potassium intake remained deficient. Clinical conditions improved, with normalization of vital signs. Biochemical parameters also improved, with increased hemoglobin and decreased creatinine and urea levels, although not yet within normal limits.

Table 1. Assessment Data

Data	Result	Standard	Interpretation
Anthropometry			
LILA	23,8 cm		Normal
LILA/U	96,35%	Malnutrition: <70% Undernutrition: 70,1 – 84,9% Normal: 85 – 110% Overweight: 110 – 120% Obese: >120%	Normal
Hematology Test			
Hemoglobin	6,6 gr/dL	11,5 – 15,5 gr/dL	Low
Hematocrit	19%	35 – 45 %	Low
Eritrosit	2,20 million/µL	4,00 – 5,20 million/µL	Low
RDW	17,9%	11,6 – 14,6%	High
PDW	16	25- 65	Low
Neutrophils	93,50%	29,00 – 72,00%	High
Lymphocytes	52,0%	60,00 – 66,00%	Low
Clinical Chemistry Test			
Albumin	3,6 gr/dL	3,8 – 5,4 gr/dL	Low
Creatinine	15,6 mg/dL	0,5 – 1,0 mg/dL	High
Ureum	271 mg/dL	< 48,00 mg/dL	High
Serum Sodium	132 mmol/L	136 – 145 mmol/L	Low
Serum Potassium	5,3 mmol/L	3,3 – 5,1 mmol/L	High
Ionic Calcium	0,87 mmol/L	1,17 – 1,29 mmol/L	Low
Clinical Physical Exmination			
Consciousness	Compos mentis	Compos mentis	Normal
General condition	Weak and short of breath	Shortness of breath improved	
	Edema of the face and extremities	-	
	Anemic Conjunctiva	-	-
	Moist oral mucosa		
Respiration	28 bpm	14–20 bpm	Tachypnea
Pulse	80 bpm	60–100 bpm	Normal
Temperature	36,6 ^{0}C	36,5^{0}C-37,5^{0}C	Normal
Blood Pressure	130/90 mmHg	120/80 mmHg	Hypertension

The patient's dietary intake levels based on the 24-hour *recall* results (Table 2), compared with nutritional requirements according to the Recommended Dietary Allowances (RDAs) based on age, indicate that energy, protein, fat, carbohydrate, sodium, and potassium intakes fall into the deficit category (<70%).

Table 2. 24-Hour Recall Upon Hospital Admission

	Energy (kkal)	**Protein (gr)**	**Fat (gr)**	**Carbohydrates (gr)**	**Sodium (mg)**	**Potassium (mg)**
Intake	724	26,4 gr	15,3 gr	117,3 gr	249,3	392,6
Requirements	1.614	48 gr	80 gr	350 gr	1500	1320
% of Daily Value	44,8%	55%	19,1%	33,5%	16,62%	29,7%
Interpretation	Deficit	Deficit	Deficit	Deficit	Deficit	Deficit

Nutritional status monitoring based on anthropometric data (Table 3) could not be conducted through direct weight and height measurements as the patient was unable to stand properly. Therefore, the anthropometric assessment focused on Mid-Upper Arm Circumference (MUAC) measurements, while biochemical, physical, and clinical monitoring utilized secondary data obtained from the patient's medical records. Monitoring of clinical physical data indicated that the patient's general condition still appeared to be moderately ill, with *the patient fully alert*. Vital sign monitoring results on May 19, 2023, showed that blood pressure, pulse, respiratory rate, and body temperature were within normal limits. Bpjriochemical data monitoring and evaluation were not performed on May 17 and 18, 2023, so test results were only available on May 19, 2023. The test results showed that hemoglobin, hematocrit, and red blood cell levels had increased compared to previous readings, although they remained below normal values. Meanwhile, creatinine and urea levels had decreased but had not yet reached normal limits. Serum albumin, potassium, and sodium levels were within normal limits.

Table 3. Monitoring and Evaluation of the Standart Nutritional Care Process

Data	**Day 1 (May 17, 2023)**	**Day 2 (May 18, 2023)**	**Day 3 (May 19, 2023)**	**Interpretation**
Anthropometry				
LILA	23,8	23,8	23,8	Normal
Physical/Clinical				
General condition	Appears Moderately ill	Weak	Appears to be moderately ill	Normal
Consciousness	Compos Mentis	Compos Mentis	Compos Mentis	
Blood Pressure	120/90 mmHg	120/90 mmHg	120/80 mmHg	120/80 mmHg
Pulse	78 bpm	78 bpm	76 bpm	60–100 bpm
Respiration	20 bpm	23 bpm	20 bpm	14–20 bpm
Temperature	36,9°C	36,5°C	36,7°C	36,5^{0}C-37,5^{0}C
Biochemical Data	-	-	-	-
Hemoglobin	-	-	7,9 g/dL	11,5 – 15,5 g/dl
Hematocrit	-	-	22%	35 – 45%
Eritrosit	-	-	2,58 million/µL	4,00 - 5,20 million/µL
Albumin	-	-	4,1 g/dL	3,8 – 5,4 g/dL
Creatinine	-	-	5,6 mg/dL	0,5 – 1,0 mg/dL
Ureum	-	-	104 mg/dL	< 48,00 mg/dL
Serum Sodium	-	-	137 mmol/L	136 – 145 mmol/L
Serum Potassium	-	-	3,4 mmol/L	3,3 – 5,1 mmol/L

Based on the results of dietary intake monitoring (Table 4) on May 17, 18, and 19, 2023, there was an upward trend in intake from the first to the third day, although not all components of nutritional adequacy reached the "good" category. The average intake over the three days showed that energy, carbohydrate, sodium and potassium intakes were still classified as deficient (<70%), while protein, and fat, intakes were in the insufficient category (70–80%).

Table 4. Monitoring and Evaluation of Nutrition Intake

Date		Energy (kkal)	Protein (gr)	Fat (gr)	Carbo (gr)	Natrium (mg)	Kalium (mg)
May 17, 2023	Oral	671,6	25,9	24,8	85,42	127,8	472,9
	Parenteral	19,2	-	-	4,8	236,48	
	Requirements	1.711	42	47,5	278,9	690	1320
	% of Intake	40,4%	61,6%	52,2%	32,3%	52,8%	35,8%
	Interpretation	Deficit	Deficit	Deficit	Deficit	Deficit	Defisit
May 18, 2023	Oral	919,1	46,2	41,3	89,8	178,8	640,0
	Parenteral	19,2	-	-	4,8	236,48	
	Requirements	1.711	42	47,5	278,9	690	1320
	% of Intake	54,8%	110%	86,9%	33,9%	60,2%	48,5%
	Interpretation	Deficit	Good	Good	Deficit	Deficit	Defisit
May 19, 2023	Oral	1.010,3	47,7	41,7	107,9	425,1	640,0
	Parenteral	19,2	-	-	4,8	236,48	
	Requirements	1.711	42	47,5	278,9	690	1320
	% of Intake	60,2%	113,6%	87,8%	40,4%	95,9%	48,5%
	Interpretation	Deficit	Excessive intake	Good	Deficit	Good	Defisit
Average Intake		886,2	31,3	35,9	99,2	480,38	564,7
Requirements		1.711	42	47,5	278,9	690	1320
% of intake		51,8%	74,5%	75,6%	35,5%	69,6%	42,8%
Interpretation		Deficit	Inadequate intake	Inadequate intake	Deficit	Inadequate intake	Inadequate intake

4. DISCUSSION

The recommended dietary management for pediatric patients undergoing hemodialysis with hypertension includes a Hemodialysis (HD) diet combined with a Low-Sodium II diet. This intervention aims not only to replace protein loss during hemodialysis and control blood pressure through sodium restriction (7), but also to prevent fluid overload that may exacerbate cardiovascular conditions, including pulmonary edema (8). The assessment identified multiple interrelated nutritional problems, including: (1) inadequate oral intake due to decreased appetite, as indicated by a 24-hour recall showing deficits (<70%) in energy (44.8%), protein (55%), fat (33.5%), and carbohydrates (33.5%); (2) sodium-related imbalance associated with hypertension, reflected by blood pressure exceeding normal limits (130/90 mmHg); and (3) altered nutrition-related laboratory values due to renal dysfunction, evidenced by elevated creatinine (15.6 mg/dL) and urea (271 mg/dL). These conditions contribute to impaired fluid balance. In patients with rheumatic heart disease (RHD), such imbalance may increase hydrostatic pressure in the pulmonary circulation, thereby triggering pulmonary edema (9). Anthropometric assessment indicated that nutritional status remained within the normal range and was stable during monitoring. In patients with limited mobility and edema, Mid-Upper Arm Circumference (MUAC) is preferred over body weight as it better reflects muscle and fat reserves (10). However, despite normal anthropometric status, dietary intake remained inadequate. Nevertheless, a consistent increase in intake from day one to day three (Table 4) indicates a positive response to the intervention. Improvement in intake was supported by dietary modifications, including soft-textured foods to facilitate consumption during dyspnea and cooking methods such as steaming or boiling to limit excess fat. Protein intake focused on high biological value sources, such as egg whites, to support albumin synthesis, consistent with recommendations for hemodialysis patients (11).

Despite improved intake, metabolic factors continued to influence appetite. Elevated creatinine and urea levels observed on day three (Table 3) may induce anorexia, nausea, vomiting, and fatigue due to uremic toxin accumulation (12). Thus, inadequate intake is influenced not only by dietary factors but also by the underlying metabolic condition. Clinical monitoring also indicated persistent edema related to fluid and electrolyte imbalance. Sodium restriction is essential to prevent fluid retention that may worsen edema and dyspnea. Additionally, uncontrolled hypertension can cause renal vascular damage and impair oxygen and nutrient delivery to nephrons (13). In this context, blood pressure control is a critical component of management. Sodium restriction showed favorable outcomes, with blood pressure returning to normal levels by day three, although pharmacological therapy also contributed. Therefore, fluid and blood pressure management are integral to CKD treatment. Improvements in clinical condition were supported by biochemical findings. Hemoglobin, hematocrit, and erythrocyte levels increased by day three, although still below normal values. Meanwhile, creatinine and urea levels decreased, reflecting the effect of hemodialysis in removing metabolic waste. However, anemia persisted due to reduced erythropoietin production, a common complication of CKD (14).

The provision of specific nutrients, particularly unsaturated fatty acids, is essential for reducing inflammation and cardiovascular risk in pediatric CKD patients. Omega-3 polyunsaturated fatty acids (PUFAs) are known to improve lipid profiles and indirectly reduce cardiac workload (13). In this clinical case, Omega-3 intake was integrated into the dietary regimen through high-biological-value protein and fat sources. Although these fatty acids were not calculated separately from the total fat intake in the daily nutritional analysis, their inclusion served as a supportive element in managing the patient's cardiovascular health and clinical stability. The clinical improvement observed in this pediatric patient is the result of a multidisciplinary approach. Therefore, it is crucial to distinguish between the direct effects of nutritional interventions and medical therapies. The progressive reduction in fluid retention (pulmonary edema) and the stabilization of blood pressure were primarily driven by routine hemodialysis and pharmacological therapies for both hypertension and Rheumatic Heart Disease (RHD). Nevertheless, nutritional management specifically strict restrictions on fluid, sodium, and potassium intake served as an essential supportive pillar. Non-adherence to this dietary prescription can compromise the efficacy of hemodialysis and elevate the risk of intradialytic complications. These findings are consistent with the study by Herviana (7), which emphasized the necessity of specific nutritional management for pediatric patients with Stage V CKD. Such interventions include a specific dialysis diet to replace amino acids lost during the procedure, alongside a low-sodium diet to control hypertension and prevent edema. Pathophysiologically, increased sodium intake expands intravascular volume and elevates capillary hydrostatic pressure. This condition triggers the extravasation of fluid from the vascular compartment into the interstitial (extracellular) space, which clinically manifests as edema (15).

There are several limitations to this case report that must be acknowledged. First, the short observation duration limits the ability to evaluate the long-term impact and sustainability of the nutritional intervention on the patient's growth and overall clinical outcomes. Second, owing to the single-case design, these findings are highly specific to a pediatric patient with Stage V CKD complicated by Rheumatic Heart Disease (RHD) and pulmonary edema. Consequently, these results cannot be generalized to the broader pediatric CKD population. Future studies with larger sample sizes, longer follow-up periods, and more comprehensive clinical measurements are warranted to validate the efficacy of this nutritional management protocol. Overall, the findings demonstrate that nutritional intervention, when integrated with hemodialysis and medical therapy, contributes to improved dietary intake, maintenance of nutritional status, and better clinical and biochemical outcomes.

5. CONCLUSION

The implementation of a hemodialysis diet and Low-Sodium II diet in pediatric patients with CKD accompanied by hypertension and suspected RHD improved dietary intake, maintained nutritional status stability, and improved clinical and biochemical parameters. Sodium restriction and fluid management play an important role in controlling blood pressure and preventing fluid overload, including pulmonary edema.

REFERENCES

1. Padoan F, Guarnaroli M, Brugnara M, Piacentini G, Pietrobelli A, Pecoraro L. Role of Nutrients in Pediatric Non-Dialysis Chronic Kidney Disease: From Pathogenesis to Correct Supplementation. *Biomedicines*. 2024;12(4):911. doi:10.3390/biomedicines12040911

2. RISKESDAS. *Laporan Nasional RISKESDAS 2018*. Kementrian Kesehatan Republik Indonesia Badan Penelitian dan Pengembangan Kesehatan; 2019.

3. Rivaldi R, Cahyadi E, Saida SA. Hubungan Antara Hipertensi dan Penyakit Ginjal Kronis Pada Pasien di Rumah Sakit Meuraxa Kota Banda Aceh. *The Journal of Multidisciplinary Research on Scientific and Advanced*. 2025;3(4):1949-1954. doi:https://doi.org/10.61579/future.v3i4.629

4. Mao C, Sun X, Long D, et al. Epidemiological study of pediatric rheumatic heart disease: An analysis from the Global Burden of Disease Study 2019. *International Journal of Cardiology*. 2024;400:131705. doi:10.1016/j.ijcard.2023.131705

5. Faridi A, Putri NR, Hutomo CS, et al. *Gizi Dalam Daur Kehidupan*. 2022.

6. Alvarez JL, Dent N, Browne L, Myatt M, Briend A. Mid-Upper Arm Circumference (MUAC) shows strong geographical variations in children with edema: results from 2277

surveys in 55 countries. *Arch Public Health*. 2018;76(1):58. doi:10.1186/s13690-018-0290-4

7. Herviana, Ananda KR, Rusliana E, Ekorinawati W, Simamora HS. The Nutrition Care Process in Hospitalized Patients with Chronic Kidney Disease Stage V, Pancytopenia, and Hypertension. *JURNAL KESMAS DAN GIZI (JKG)*. 2025;8(1):750-757. doi:10.35451/f83acv69

8. Dugal JK, Malhi AS, Ramazani N, Yee B, DiCaro MV, Lei K. Non-Pharmacological Therapy in Heart Failure and Management of Heart Failure in Special Populations—A Review. *J Clin Med*. 2024;13(22):6993. doi:10.3390/jcm13226993

9. Tetaj N, Capecchi G, Rubino D, et al. Respiratory Support in Cardiogenic Pulmonary Edema: Clinical Insights from Cardiology and Intensive Care. *Journal of Cardiovascular Development and Disease*. 2026;13(1):54. doi:10.3390/jcdd13010054

10. Herawati AT, Alow, GBH, Rokot A, et al. *GIZI KLINIS DAN TERAPI DIET TERINTEGRASI*. Perkumpulan Pendidikan dan Pelatihan Tenaga Kesehatan; 2026.

11. Yogyantini MDT, Bernadeth Dwi Wahyunani. HUBUNGAN ASUPAN ZAT GIZI DENGAN STATUS GIZI PADA PASIEN GAGAL GINJAL KRONIK DENGAN HEMODIALISA DI RUMAH SAKIT PANTI RAPIH YOGYAKARTA. In: *Prosiding Temu Ilmiah Nasional PERSAGI Tahun 2023*. Vol 1. 2023:121-130.

12. Arhamawati S, Saryono S, Awaluddin S. Correlation between the levels of urea serum, creatinine, and haemoglobin with fatigue in patient with Chronic Kidney Disease at Haemodialisa Unit, dr. R. Goeteng Taroenadibrata General Hospital Purbalingga. *JoB*. 2019;1(1):34-46. doi:10.20884/1.bion.2019.1.1.8

13. Ansari MN. The Impact of Hypertension on Renal Function: Mechanisms and Therapeutic Approaches in the U.S. Population. *Journal of Chemical Health Risks*. 2025;15(1):912-921. doi:10.52783/jchr.v15.i1.7603

14. Hasanah U, Hammad H, Rachmadi A. Hubungan Kadar Ureum Dan Kreatinin Dengan Tingkat Fatigue Pada Pasien Chronic Kidney Disease (CKD) Yang Menjalani Hemodialisa. *JURNAL CITRA KEPERAWATAN*. 2020;8(2):86-92. doi:10.31964/jck.v8i2.158

15. Bernal A, Zafra MA, Simón MJ, Mahía J. Sodium Homeostasis, a Balance Necessary for Life. *Nutrients*. 2023;15(2):395. doi:10.3390/nu15020395