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Factors causing increased interdialytic weight gain in chronic kidney disease patients followed by hemodialysis

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ABSTRAK

Latar Belakang: *Gagal ginjal kronis bersifat irreversible akibat kerusakan baik strukur maupun fungsinya yang berlangsung tiga bulan atau lebih. Salah satu terapi penunjang pada pasien gagal ginjal kronis adalah hemodialisa. Permasalah yang sering muncul pada pasein hemodialisa adalah kenaikan berat badan di antara dua waktu dialisis atau Interdialytic Weight Gain (IDWG) yang berlebih dan akan memiliki dampak pada kualitas Kesehatan pasien.*
Tujuan: *Mengetahui faktor internal dan eksternal eksternal yang dapat menyebabkan IDWG. Faktor internal yaitu meliputi usia, jenis kelamin, tingkat stress, rasa haus, dan riwayat pendidikan. Faktor eksternal yaitu dukungan keluarga, jumlah asupan cairan, lama telah menjalankan hemodialisa, asupan energi, dan asupan protein..*
Metode: *Penelitian ini merupakan penelitian deskriptif analitik dengan desain cross sectional. sebanyak 57 sampel yang dipilih secara purposive sampling menyetujui ikut serta dalam penelitian. Uji statistik dilakukan dengan chi square. Analisis dilakukan hingga multivariat untuk mengetahui variabel independent yang paling mempengaruhi variabel dependent.*
Hasil: *Hasil menunjukkan mayoritas responden dewasa (75,4%), perempuan (59,6%), stress ringan (61,4%), rasa haus sedang (40,4%), riwayat pendidikan rendah (73,7%), asupan cairan lebih (59,6%), dukungan keluarga yang baik (49,1%), hemodialisa <12 bulan (66,7%), asupan energi tidak sesuai (82,5%), asupan protein tidak sesuai (89,5%). Hasil dari uji statistik didapatkan tidak ada hubungan antara usia (p = 0,827), jenis kelamin (p = 0,925), riwayat pendidikan (p = 1,000), lama telah menjalankan hemodialisa (p = 0,343), asupan energi (p = 1,000), dan asupan protein (p = 1,000) dengan IDWG. Namun, terdapat hubungan signifikan antara tingkat stress (p = 0,027), rasa haus (p = 0,027), asupan cairan (p = 0,014), dukungan keluarga (p = 0,038) dengan IDWG pada pasien gagal ginjal kronis dengan hemodialisa di RSUP. Dr. Mohammad Hoesin Palembang.*
Kesimpulan: *Faktor yang berhubungan dengan IDWG adalah stress, rasa haus, asupan cairan dan dukungan keluarga. Faktor yang tidak berhubungan dengan kejadian IDWG adalah usia, jenis kelamin, riwayat pendidikan, lama telah menjalankan hemodialisa, asupan energi dan asupan protein. Dukungan keluarga yang baik paling berpengaruh kepada pasien untuk memiliki IDWG yang normal.*

KATA KUNCI*: interdialytic weight gain; hemodialisa; faktor penyebab*

ABSTRACT

Background: *Chronic kidney failure is irreversible due to damage to both its structure and function that lasts three months or more. One of the supporting therapies for patients with chronic kidney failure is hemodialysis. A problem that often arises in hemodialysis patients is excessive weight gain between two dialysis sessions, or Interdialytic Weight Gain (IDWG), which can impact the quality of the patient's health.*

Objectives: *To determine the factors that cause an increase in IDWG, including internal and external factors. Internal factors are age, sex, stress, thirst, and education history. External factors are family support, fluid intake, duration of hemodialysis, energy intake, and protein intake.*

Methods: *This research was a descriptive-analytical study with a cross-sectional design. A total of 57 samples selected by purposive sampling agreed to participate in the research. Statistical tests were carried out using chi-square. An analysis was conducted using a multivariate analysis to determine which independent variable is the most affected dependent variable.*

Results: *The results showed that the majority of respondents were adults (75.4%), female (59.6%), mild stress (61.4%), moderate thirst (40.4%), low education (73.7%), higher fluid intake (59.6%), family support (49.1%), hemodialysis <12 months (66.7%), inadequate energy intake (82.5%), inadequate protein intake (89.5%). The results of statistical tests found no relationship between age (p = 0.827), sex (p = 0.925), education history (p = 1,000), time on hemodialysis (p = 0.343), energy intake (p = 1,000), and protein intake (p = 1.000) with IDWG. However, there was a significant relationship between stress level (p = 0.027), thirst (p = 0.027), fluid intake (p = 0.014), and family support (p = 0.038) with IDWG in chronic kidney disease patients with hemodialysis at RSUP. Dr. Mohammad Hoesin Palembang.*

Conclusions: *Factors associated with IDWG were level, thirst, fluid intake, and family support. Factors not associated with the incidence of IDWG were age, gender, education history, length of hemodialysis, energy intake, and protein intake. Appropriate family support affected the patients to have normal IDWG.*

KEYWORD***:*** *interdialytic weight gain; chronic kidney disease; hemodialysis; factors causing*

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INTRODUCTION

Chronic kidney disease is an irreversible degenerative disease caused by damage to kidney structures or function that lasts for 3 months or more (1,2). Riskesdas Indonesian Basic Health Research (RISKESDAS) is a study conducted every five years to collect community-based data that can be used as risk factors, the development of public health status, and health development progress from the city or district to the national level by Health Research and Development Unit from Ministry of Health of the Republic of Indonesia, showed the prevalence of chronic kidney disease in 2018 was 0.38% (3,4). Indonesian Renal Registry (IRR) 2018 mentioned 132.142 cases of hemodialysis patients (4). The intention of hemodialysis is to remove leftover metabolic waste and fluids that are not used anymore from the body (5). Several renal replacement therapies (RRT) have been applied, and one of them is hemodialysis. Hemodialysis is carried out to support quality of life for the future (5). Hemodialysis is commonly performed twice a week for about 4 to 5 hours and is scheduled for each patient (4). However, the most common problem caused by hemodialysis is the Interdialytic Weight Gain (IDWG) (6). Interdialytic Weight Gain (IDWG) is caused by internal and external factors. The internal factors include age, sex, thirst, stress, and education history. The external factors are caused by fluid intake and

family support (7). Increasing Interdialytic Weight Gain (IDWG) more than 5% of dry weight will cause complications such as hypertension, edema, and breathlessness (8). Other effects that will happen are nausea, vomiting, discomfort, and muscle cramps (9). Furthermore, 60% - 80% of patients died from excess fluid intake during the periods of dialysis (7). IRR explained that in 2018, 2.333 patients did hemodialysis in South Sumatra (8). In the southern Sumatra region, RSUP. Dr. Mohammad Hoesin has become the largest hospital and the referral hospital for five provinces on Sumatera Island. Based on the medical record RSUP. Dr. Mohammad Hoesin, from the last research, there are 652 patients with chronic kidney disease. Furthermore, in one day, the 74 patients had to do hemodialysis, which was repeated routinely twice a week (10). As mentioned before, the common output from hemodialysis is the weight gain between two hemodialysis schedules, causing Interdialytic Weight Gain (IDWG). It is totally normal until it passes from the cut-off points. Then, it will cause complications such as edema and breathlessness. Weight gain, also known as Interdialytic Weight Gain (IDWG), is caused by some factors. Therefore, this research wants to know the factors causing Interdialytic at RSUP. Dr. Mohammad Hoesin Palembang.

MATERIALS AND METHODS

This study is an analytic descriptive with a cross-sectional design. This research was conducted at RSUP. Dr. Mohammad Hoesin in October 2023. The population of this study was chronic kidney disease patients with hemodialysis at RSUP, which were determined by an infinite population. The final samples were determined using a hypothesis test for two population proportions by Lemeshow, with the final result of 57 samples, which were 34 women and 23 men (11). The inclusion criteria for this study are patients willing to be respondents, outpatients, being able to communicate, and having an age range starting from 19 years old until the eldest one routinely does hemodialysis twice a week, and minimum already had hemodialysis for a week. The exclusion criteria are patients living alone and not routinely doing hemodialysis.

The primary data were taken for 3 days and decided into the first day as the first meeting of hemodialysis, the second day as excluding hemodialysis, and the third day as the second meeting of hemodialysis. The data consists of weight before and after HD 1, weight before and after HD 2, age, sex, education history, family support, fluid intake, urine output, and food recall 2 x 24 hours.

Univariate, bivariate, and multivariate analyses will be used for this research. It was conducted using an analytical descriptive quantitative approach with a cross-sectional design. In addition, the analysis used a chi-square test with CI 95% ($\alpha = 0,05$). The primary data was collected for seven days on the day of hemodialysis. This research has eleven variables, each of which has its classification. Initially, Interdialytic Weight Gain (IDWG) with the classification of normal (0% - 5%) and abnormal (>5%) from dry weight percentage is calculated using the formula %IDWG = (Weight pre HD 2-Weight post HD 1)/(Weight post HD 1) x 100%. The age classification consists of adults who are 19 years old until 49 years old and elderly people who are more than 49 years old (12). Classification of sex consists of females and males. The classification of education level consists of higher education and lower education. Lower education starts in primary school, middle school, and high school. However, higher education starts with a diploma and continues to the field of doctoral degrees (13).

The classification of thirst level consists of low, moderate, and severe. It is classified using the Visual Analogue Scale (VAS) to determine thirst between two hemodialysis schedules (14). Classification of stress levels consists of low, moderate, and severe. It is classified by using Depression Anxiety Stress Scales 42 to determine the feelings that respondents felt between two hemodialysis schedules (15). Fluid intake with the classification of appropriate (less than 500 ml/day + urine output) and inappropriate (more than recommended) by using food recall, questionnaire, and measuring cup. It aims to determine the respondent's fluid intake between two days of the hemodialysis schedule (16).

Family support with the classification of appropriate and inappropriate. It determines the

respondent's perception of support from their family and is counted using the Likert scale. The duration of hemodialysis with the classification of <12 months and ≥ 12 months (17). It aims to know the duration that each respondent has passed from the first day until the day of data collection. Energy intake is classified as adequate (25 – 35 ccal/kg/W/day) and inadequate (<25 – >35 ccal/kg/W/day). Protein intake is classified as adequate (1 – 1.2 g/kg/W/day) and inadequate (less than 1 – 1.2 g/kg/W/day and more than 1 – 1.2 g/kg/W/day) (18). Either energy or protein is used in the Food Recall Form 2 x 24 hours. The aim of using recall 2 x 24 hours is to get information on food intake during the gap of hemodialysis schedules and use a food model book to make the food recall process easier. The energy intake for two days is totaled and then divided by two to get the average energy compared to personal needs, which are 25 - 35 kcal/kgBW/d. The same goes for protein intake; two days of protein intake are totaled and then divided by two to get the average protein and compared to personal needs, which is 1.2 g/kgBW/d (19).

Multivariate analysis was conducted by correlating several independent variables with one dependent variable at the same time and considering the total samples. Furthermore, multivariate analysis aims to determine the independent variable with the biggest influence on the dependent variable. In addition, the test uses logistic regression analysis, which uses a prediction model.

This research has received an ethical review from the Hospital's Ethics Committee. Dr. Mohammad Hoesin Palembang with ethical number No.DP.04.03/D.XVIII.6.8/ETIK/122/2023. This research used the informed consent from Ethical Committee RSUP Dr. Mohammad Hoesin Palembang to ensure the patients were fine with the research that would be accomplished for a couple of days without any coercion.

RESULTS AND DISCUSSIONS

Characteristics of Respondents

Univariate analyses conducted in this study were age, gender, stress level, thirst, education history, fluid intake, family support, duration of hemodialysis, energy intake, and protein-protein. The final respondents were 57 samples. There were 43 people (75.4%) have normal IDWG. There are 36 adults (63.2%), and the rest are elderly. There are 34 females (59.6%) and 23 males (40.4%). There were 15 people (26.3%) who had a history of high education, 35 people (61.4%) had mild stress, 20 people (35.1%) experiencing mild thirst, 23 people (40.4%) had an appropriate fluid intake, 28 people (49.1%) had appropriate family support, 38 people (66.7%) who had done hemodialysis >12 months, ten people (17.5%) who had adequate energy intake and six people (10.5%) who had adequate protein intake.

Table 1. Characteristics of Respondent (N=167)

Variable	n (57)	%
IDWG (*Interdialytic Weight Gain*)		
Normal (0% - 5%)	43	75.4
Abnormal (>5%)	14	24.6
Age		
Adult (19 – 49 tahun)	36	63.2
Elderly (> 49 tahun)	21	36.8
Sex		
Women	34	58.6
Men	23	40.4
Education history		
Higher education	15	26.3
Lower education	42	73.7
Stress Level		
Low	35	61.4
Moderate	16	28.1
Severe	6	10.5
Thirst		

Variable	n (57)	%
Low	20	35.1
Moderate	23	40.4
Severe	14	24.6
Fluid Intake		
Appropriate	23	40.4
Inappropriate	34	59.6
Family Support		
Appropriate	28	49.1
Inappropriate	29	50.9
Duration of Hemodialysis		
<12 months	38	66.7
≥12 months	19	33.3
Energy Intake		
Adequat (25 - 35 kcal/kgBW/d)	10	17.5
Inadequat (< 25 kcal/kgBW/d or > 35 kcal/kgBW/d)	47	82.5
Protein Intake		
Adequat (1.2 g/kgBW/d)	6	10.5
Inadequat (< 1.2 g/kgBW/d)	51	89.5

The most dominant factor affecting IDWG was fluid intake. Individuals who had greater fluid intake were ten times more likely to have a normal IDWG than those who did not after controlling for family support, thirst, and stress. Interdialytic Weight Gain (IDWG) can occur at any age because older people may not have the compliance to limit fluid intake and vice versa (20). Younger patients tend to consume more fluids due to diverse physical activities (21). Younger patients who undergo hemodialysis feel less vulnerable to complications and consider hemodialysis therapy to be a lifelong intervention (22).

Table 2. Bivariate Analysi

Characteristics	Interdialytic Weight Gain		*P* value
	Normal	Abnormal	
Age			
Adult	28 (77.8)	8 (22.2)	0.827
Elderly	15 (71.4)	6 (28.6)	
Sex			
Women	25 (73.5)	9 (26.5)	0.925
Men	18 (78.3)	5 (21.7)	
Education History			
Higher education	11 (73.3)	4 (26.7)	1.000
Lower education	32 (76.2)	10 (23.8)	
Stress Level			
Low	41 (80.4)	10 (19.6)	0.027
Severe	2 (33.3)	4 (66.7)	
Thirst			
Moderate	36 (83.7)	7 (16.3)	0.027
Severe	7 (50.0)	7 (50.5)	
Fluid Intake			
Appropriate	21 (95.5)	1 (4.5)	0.014
Inappropriate	22 (62.9)	13 (37.1)	
Family Support			
Appropriate	25 (89.3)	3 (10.7)	0.038
Inappropriate	18 (62.1)	11 (37.9)	
Duration of Hemodialysis			

<12 months	27 (71.1)	11 (28.9)	0.343
≥ 12 months	16 (84.2)	3 (15.8)	
Energy Intake			
Adequat (25 - 35 kcal/kgBW/d)	8 (80.0)	2 (20.0)	1.000
Inadequat (< 25 kcal/kgBW/d or > 35 kcal/kgBW/d)	35 (74.5)	12 (25.5)	
Protein Intake	5 (83.3)	1 (16.7)	1.000
Adequat (1.2 g/kgBW/d)	38 (74.5)	13 (25.2)	
Inadequat (< 1.2 g/kgBW/d)			

The method for bivariate analysis using chi-square with a CI of 95%.

Table 5. Multivariate Analysis

Variable	B	S.E.	Wald	df	Sig.	Exp (B)
Fluid Intake	2.314	1.205	3.687	1	0.055	10.119
Thirst	1.187	0.816	2.116	1	0.146	3.277
Fam	1.188	0.835	2.026	1	0.155	3.281
Stress	1.579	1.076	2.150	1	0.143	4.848
Constant	-2.021	1.080	3.505	1	0.061	0.132

Both males and females have the same risk factors for increasing Interdialytic Weight Gain (IDWG) (23). Nevertheless, from another study, male patients have a higher risk than females in the incidence of chronic kidney disease. Hence, females have more estrogen hormones than males. This hormone acts as an inhibitor for oxalate absorption, which can cause Chronic kidney disease (24).

Knowledge is an important component of decision-making and action. Low education will cause a person to behave negatively due to limited acceptance of available information (25). Indirectly, education history will affect self-management and information acceptance (26). However, the educational history of a person does not really affect the habits carried out by individuals because each individual has a different way of processing the information received (23).

Severe thirst will make a person tend to drink more fluids (27). Thirst can be caused by the weather, dry mouth, and the obligation to take certain medications (28). The more patients try to resist thirst, the more likely patients are to consume more fluids (27). Thirst that felt by the patient causing the patient are unable to control their self to avoid drink water or eat food with high liquid on it (29). Dryness in the mouth will stimulate the oral nerve endings, which are forwarded to the thirst center in the lateral hypothalamus, which will eventually trigger the sensation of thirst (25). Chronic kidney disease patients usually experience xerostomia or increased thirst, but the body itself experiences fluid overload and causes fluid to accumulate, resulting in weight gain. (30)

Increasing the IDWG is one of the indicators used to identify liquid intake that is already consumed by patients who are taking hemodialysis. Indeed, patients have to restrict their fluid intake by avoiding spicy food that triggers thirst, such as consuming food with high sodium, reducing the intensity of physical activity, and drinking water with strict measures. Patients have to take a look at the liquid intake from drinks and food. It can cause uremia, which is the failure of the kidney to maintain fluid and electrolyte balance (23). The further effects of it are edema, breathlessness, and decreased quality of life (31).

The fluid intake is related to thirst. The main physiological stimuli related to the thirst center are an increase in plasma concentration and a decrease in blood volume. Receptor cells will monitor osmolality, and if the body loses a lot of fluid, the receptor cells will activate thirst and send signals to the mouth, which is the side effect of dry mouth (32). Furthermore, fluid intake is important to monitor because it can cause the effects of uremia caused by kidney function failure in maintaining fluid and electrolyte balance (21). Non-compliance of chronic kidney disease patients with hemodialysis to limit fluid intake will cause the body to experience fluid overload, which will increase other problems such as edema, pulmonary edema, and decreased quality of life

(31). Depression and stress can affect a patient's behavior and habits in self-management during treatment and fluid restriction. As a result, patients tend to be non-compliant, consume excess fluids, and adopt an indiscriminate diet (33). Hemodialysis activities in chronic kidney disease patients that are carried out repeatedly and routinely can cause psychological fatigue. Lifestyle changes due to new habits to do hemodialysis cause changes in emotional stress and mood (34). Other influential factors related to stress are hypoalbuminemia and high PTH (parathyroid hormone) levels (35).

Family is the smallest part of the social environment. The family has an important role in protecting the mental and physical family members (36). On the other hand, family support can be provided through motivation, reminders, and attention to fluid intake and restriction, as recommended. Patients who get family support will feel valued, loved, and cared for, and this increases positive thoughts (29). Family takes action to remind and give a warning against daily habits. Some patients felt unmotivated to take hemodialysis therapy, and the result was fluid accumulation and toxicity in the body. In this situation, family support takes action to remind the patients and accompany them to hemodialysis therapy (23). Family support felt by patients will increase self-confidence, increase happiness, and feel valuable because patients receive both verbal and behavioral support to deal with their illness. Family support can be provided through emotional, assessment, information, or instrumental support (35). The time taken to perform hemodialysis also does not determine Interdialytic Weight Gain (IDWG). This happens because patients have different travel times. The duration of time that has been taken does not guarantee that patients with hemodialysis will comply with the fluid and sodium restriction diet (37). Therefore, the longer the patient is on hemodialysis, the greater the chance of decreased compliance (38).

It is very important to fulfill macronutrient intake in patients with chronic kidney disease. Another problem that arises is the high rate of malnutrition among chronic kidney disease patients undergoing hemodialysis (39). Limiting or even reducing energy and protein consumption to limit the increase in Interdialytic Weight Gain (IDWG) without sodium and fluid restriction will only increase the risk of PEW (protein-energy wasting) (40). Patients at risk of PEW may show signs of loss of nutrient intake, decreased appetite, and damage to lean muscle mass (41). Inadequate energy intake can cause malnutrition, along with other factors, such as gastrointestinal disorders, inflammation, and the dialysis process itself (19). Patients who conduct hemodialysis routinely will have a higher risk of malnutrition (42).

High protein intake reflects rapid metabolism in the body to produce energy, carbon dioxide, and water. Carbon will be processed through the lungs, and the water that has been produced will cause an increase in Interdialytic Weight Gain (IDWG). However, protein intake to increase Interdialytic Weight Gain (IDWG) cannot be established because there is no further research (43). High dietary intake and resultant protein degradation products may cause kidney hyperfiltration, which means it becomes the contributor to kidney function decline (44). Chronic kidney disease patients on hemodialysis are at risk of hypoalbuminemia, which has the potential to cause mortality. Protein intake will help in the gradual increase of serum albumin, but according to other studies, if serum albumin levels are too high, it will potentially increase the Interdialytic Weight Gain (IDWG) (38).

On the other hand, protein will optimize albumin to decrease mortality in chronic kidney disease patients in the first year of hemodialysis because they are vulnerable to inflammation (45). In addition, to conduct further research related to protein and IDWG, the researchers have to compare serum albumin (sAlb) to IDWG. Indeed, in terms of the interaction between sAlb and IDWG, sAlb is used as a nutritional or illness marker, especially for patients who have low sAlb and who are at risk of mortality associated with IDWG (40).

CONCLUSIONS AND RECOMMENDATIONS

There is a relationship between fluid intake, thirst, family support, and stress level with Interdialytic Weight Gain (IDWG) with hemodialysis at RSUP. Dr. Mohammad Hoesin Palembang. However, there is no relationship between age, gender, education history, duration of hemodialysis,

energy intake, and protein intake with hemodialysis at RSUP. Dr. Mohammad Hoesin Palembang. Furthermore, the most influential variable in the normal IDWG is the significant fluid intake rather than another variable.

For hospitals, the data obtained can be used as additional information to conduct in-depth counseling to patients and their families by health workers such as doctors, nurses, and nutritionists. Therefore, families have to provide support and encouragement to patients and play a role in regulating diet at home. In addition, patients always give positive affirmations to themselves, eat macronutrients based on the recommendation from the doctor or dietitian, and limit daily fluid intake.

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