UNIVERSITI PUTRA MALAYSIA

ASSESSING MALNUTRITION AMONG DIALYSIS PATIENTS IN HOSPITAL SERDANG AND HOSPITAL KUALA LUMPUR

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A project submitted as partial fulfillment of the requirement for the degree of Bachelor of Science (Dietetics) from the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia

The project entitled “Assessing malnutrition among dialysis patients in Hospital Serdang and Hospital Kuala Lumpur” was prepared by Nurul Syazlin Binti Anuar and submitted to the Faculty of Medicine and Health Sciences as partial fulfillment of the requirement for the degree of Bachelor of Science (Dietetics) from the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

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ABSTRACT

ASSESSING MALNUTRITION AMONG DIALYSIS PATIENTS IN HOSPITAL SERDANG AND HOSPITAL KUALA LUMPUR

Nurul Syazlin Binti Anuar

End-stage Renal Disease Patients undergoing hemodialysis (HD) and peritoneal dialysis (PD) treatment experiences heightened risk for malnutrition. However, the proportion of malnourished dialysis patients reported in government hospitals in Malaysia is lacking. The current study aimed to determine malnutrition among dialysis patients in Hospital Serdang and Hospital Kuala Lumpur. This was a cross-sectional study using convenient sampling design. Socio-demographic, medical history and biochemical data were obtained from patients' medical record whilst nutritional parameters including anthropometry, physical function (hand-grip strength) and dietary intake (3 day diet recall) were measured. Risk of malnutrition was determined using a validated questionnaire (Malnutrition-Inflammation Score, MIS). A total of 82 dialysis patients (56 HD and 26 PD) were recruited. There were 51.2% of male and 48.8% of female patients with a median age of 57 years old. MIS indicate that 53.6% and 57.7% of HD and PD patients were respectively malnourished (score ≥5). Dietary analysis indicated that, only 37.1% of the patients consumed adequate energy intake with the median 24.80 Kcal/kg IBW/day, and only 14.3% of them consumed adequate protein intake with the median 0.90 g/kg IBW/day. The proportions of malnutrition among dialysis patients in both modalities are comparably high. Thus, regular monitoring, identification, and management of malnutrition in these patients are important to improve their survival and quality of life.

ABSTRAK

PENILAIAN MALPEMAKANAN DALAM KALANGAN PESAKIT DIALISIS DI HOSPITAL SERDANG DAN HOSPITAL KUALA LUMPUR

Nurul Syazlin Binti Anuar

Pesakit penyakit ginjal peringkat akhir yang manjalani hemodialysis dan rawatan dialisis peritoneal mengalami peningkatan risiko malnutrisi. Walau bagaimanapun, jumlah pesakit dialisis yang mengalami malnutrisi yang dilaporkan di hospital kerajaan di Malaysia adalah kurang. Kajian yang dilakukan ini bertujuan untuk menentukan malnutrisi dalam kalangan pesakit dialysis di Hospital Serdang dan Hospital Kuala Lumpur. Ini adalah kajian keratan rentas yang menggunakan reka bentuk persampelan yang mudah. Rekod kesihatan pesakit digunakan untuk mendapatkan data mengenai socio-demografi, sejarah perubatan dan data biokimia manakala parameter pemakanan termasuklah pengukuran antropometri, fungsi fizikal (kekuatan gengaman tangan), dan pengambilan makanan (pemakanan 3 hari) telah diukur dan direkod. Risiko malnutrisi ditentukan dengan menggunakan soal selidik yang telah disahkan iaitu Malnutrition Inflammation Score (MIS). Seramai 82 pesakit dialisis (56 HD dan 26 PD) telah direkrut. Terdapat 51.2% pesakit lelaki dan 48.8% pesakit wanita dengan usia rata-rata 57 tahun. MIS menunjukkan, 53.6% dan 57.7% dari jumlah pesakit HD dan PD mengalami malnutrisi (skor ≥5). Pemakanan selama 3 hari menunjukkan, hanya 37.1% pesakit yang memenuhi pengambilan tenaga yang mencukupi dengan median 24.80 kcal/Kg IBW/hari dan hanya 14.3% dari mereka yang memenuhi pengambilan protein yang mencukupi dengan median 0.90 g/Kg IBW/hari. Kadar malnutrisi dalam kalangan pesakit dialysis adalah tinggi. Oleh itu, pemantauan, pengenalpastian dan pengurusan malnutrisi secara berkala pada pesakit dialysis adalah penting untuk meningkatkan kelangsungan hidup dan kualiti hidup mereka.

CHAPTER 1

INTRODUCTION

1.1 Background

The primary function of the kidney is to filter the blood. Along this process, the kidney will remove wastes, extra fluids, and balancing the level of the electrolytes in the body (Hoffman, 2014). There are two types of renal failure which are acute renal failure and chronic renal failure. Acute renal failure can be defined as a sudden fall in the rate of glomerular filtration that usually occurs less than a few days and is usually reversible(Hilton, 2011). Meanwhile, chronic renal failure is the abnormalities of the kidney or when the glomerular filtration rate (GFR) is less than 60ml/min/1.73m2 for at least 3 months with or without kidney damage (Kipp & Kellerman, 2009). ESRD is defined as a loss or reduced renal function to less than 10 percent of normal capacity and will need kidney transplantation or dialysis for survival (Tulchinsky & Varavikova, 2014).

There are three types of renal replacement therapy, which are renal transplantation, hemodialysis, and peritoneal dialysis (Gilbert, Lovibond, Mooney, & Dudley, 2018). Around the world, it is estimated that the total number of HD and PD population was 2.25 million and 272,000 respectively in 2013 (Kwong & Li, 2015). The number of people that undergoing renal replacement therapy is more than 2.5 million, which is expected to increase to 5.4 million in 2030 (Liyanage et al., 2015). The number of ESRD patients that undergo hemodialysis and peritoneal dialysis in Malaysia is increasing for the past years in which from 2014 to 2016 the prevalence of HD and PD patients increase from 32730 to 34273 and 3172 to 4785 respectively (National Renal Registry, 2018). Hemodialysis is done by using a special filter that removes wastes and extra fluid

from the body (Health, 2009). Most of these patients will be required to go to a clinic for three times a week for 3 to 5 or more hours for each visit. Meanwhile, peritoneal dialysis is a daily dialysis treatment that can be performed at home. This is done by inserting dialysate fluid into the abdomen through a PD tube and will be left for several hours. The fluid inserted will collect wastes that have been filtered by the peritoneal membrane and later will be drained out from the body. There are two types of peritoneal dialysis which are automated peritoneal dialysis (APD) which requires the use of a machine called a cycler and continuous ambulatory peritoneal dialysis (CAPD) that use dialysate fluid to clean the blood and machine-free (National Kidney Foundation, 2019). Patients that undergo this treatment are free to do daily activities, less fluid and dietary restriction and less medication needed.

The American Society for Parental and Enteral Nutrition defined malnutrition as an imbalance between the requirement and intake of nutrients which lead to energy, protein, or micronutrient deficit that could adversely affect growth, development, and other related outcomes. The proportion of malnutrition among dialysis patients is very high and it is strongly associated with increased risk of mortality, morbidity, and decreased quality of life (Krishnamoorthy et al., 2015; Wi & Kim, 2017). There are 59-81% and 90% of HD and PD patients in Malaysia, respectively, are reported to experience malnutrition (Chan et al., 2019; Harvinder et al., 2016).

Since malnutrition is highly prevalent among dialysis patients; it is important to identify and treat patients that are at risk. Many nutritional screening tools can be used to detect malnutrition among dialysis patients such as subject global assessment (SGA), dialysis malnutrition score (DMS), and malnutrition inflammation score (MIS). SGA is a well-established tool to assess malnutrition among dialysis patients. However, it is less reliable and precise as its subjective evaluation and semi-quantitative scale only consist of three distinct severity levels (Harvinder et al., 2016). Another version of SGA which is DMS was developed and it is more precise and reliable compared to the previous tool (Kalantar-Zadeh, Kleiner, Dunne, Lee, & Luft, 1999). MIS then was developed with the addition of three other objective components which are BMI, serum albumin, and serum TIBC. Both DMS and MIS are useful in identifying dialysis patients that are at risk of getting malnutrition as they have sensitivity and accuracy above 50% (Harvinder et al., 2016). In this study, MIS was used as a tool to screen the patients as it has more advantages than DMS which could reflect inflammation, predict hospitalization and mortality (Harvinder et al., 2016). Furthermore, the sensitivity and accuracy of this tool are 82.1 % and 74.7% respectively (Harvinder et al., 2016).

1.2 Problem Statement

There are wide range of malnutrition rate found in various studies which ranging from 59% to 90% (Chan et al., 2019; Harvinder et al., 2016). However, the proportion of malnourished patients reported in government hospitals in Malaysia is lacking. Next, it is common for patients undergoing dialysis experiencing metabolic and nutritional deterioration, however, their nutritional status are not being assessed regularly (Khor et al., 2018). Numerous factors that can

contribute to the development of malnutrition in dialysis patients, including inadequate protein and calorie intake, loss of appetite, inflammation, loss of residual renal function, and inadequate dialysis (Wi & Kim, 2017). Various experimental and clinical data have pointed out that targeted tissue will be directly attacked by the inflammation; as well as the central nervous system that leads to dysregulation of appetite and sickness behavior such as anorexia and fatigue (Jankowska et al., 2017).

Dietary intake plays a crucial part in determining the risk of getting malnutrition. Poor dietary intake among dialysis patients is associated with a decrease in energy and protein intake. There are multiple causes of poor dietary intake such as altered taste, restricted diet, and emotional distress (*American Journal of Kidney Diesease (AJKD)*, 2009). Based on the KDOQI guideline, the recommended dietary protein intake (DPI) for dialysis patients is 1. - 1.2 g/Kg/day. Meanwhile, the requirement of dietary energy intake (DEI) for dialysis patients is 25 – 35 Kcal/Kg/day. However, most of the dialysis patients have low DEI and DPI than the recommended intake (Jadeja & Kher, 2012). The study conducted by Harvinder et al. in 2016 shows there is no association between DEI and DPI with MIS among dialysis patients. Dietary survey can give an idea of daily energy and protein intake but there may have chances of misreporting and also need food consumption data of several days to obtain the estimate of usual diet (Bhattacharya, Pal, Mukherjee, & Roy, 2019).

As for anthropometric measurement and biochemical data, some of the parameters were found to be correlated with MIS in PD patients. Triceps skinfold (TSF) and mid-arm circumference (MAC) are significantly associated with MIS among HD and PD patients (Harvinder et al., 2016).

Apart from that, serum creatinine and serum urea also significantly correlated with MIS among HD and PD patients. This is because creatinine can represent muscle mass where it produced from the muscles and is excreted with other waste products through the kidneys, while, urea is affected by the protein intake (Nisha et al., 2017). Another study also found that mid-arm circumference is correlated with MIS among PD patients but no information regarding the correlation of TSF (Naeeni et al., 2017). Other parameters such as age and dialysis vintage were found to have no correlation with MIS among HD and PD patients (Naeeni et al., 2017). It may be due to the difference in dialysis duration and means age of participants during the research duration.

There are also many inconsistent results regarding the factor correlated with MIS among dialysis patients, thus more study needs to be conducted to test the correlation of all factors with MIS especially a local study.

1.3 Research Question

1. What is the proportion of malnutrition among dialysis patients?
2. What is the association between socio-demographic background, medical history, anthropometric measurement, biochemical data, and dietary intake with malnutrition status among dialysis patients?

1.4 Significant of Study

The proposed study was conducted to determine the correlation between socio-demographic, medical history, anthropometric measurement, physical function, biochemical data, and dietary intake with MIS in a government hospital using malnutrition inflammation score. This study can provide data and information between those factors with MIS among dialysis patients. Apart from that, this study can be a platform for other researchers to refer as a guideline to create a health policymaker in making a health promotion program to improve the quality of life or to improve the nutritional status of dialysis patients.

Besides, the data from this study can be utilized to compare the requirement and adequacy of protein and energy intake of dialysis patients and at once can help their patients to improve their dietary intake while promoting a healthy lifestyle. Later, the prevalence of malnutrition among dialysis patients can be reduced and the quality of life of dialysis patients can be improved.

1.5 Objective

General Objectives

To determine the risk of malnutrition and the association between socio-demographic backgrounds, medical history, anthropometric measurement, physical function, biochemical data and dietary intake among dialysis patients in Hospital Serdang and Hospital Kuala Lumpur.

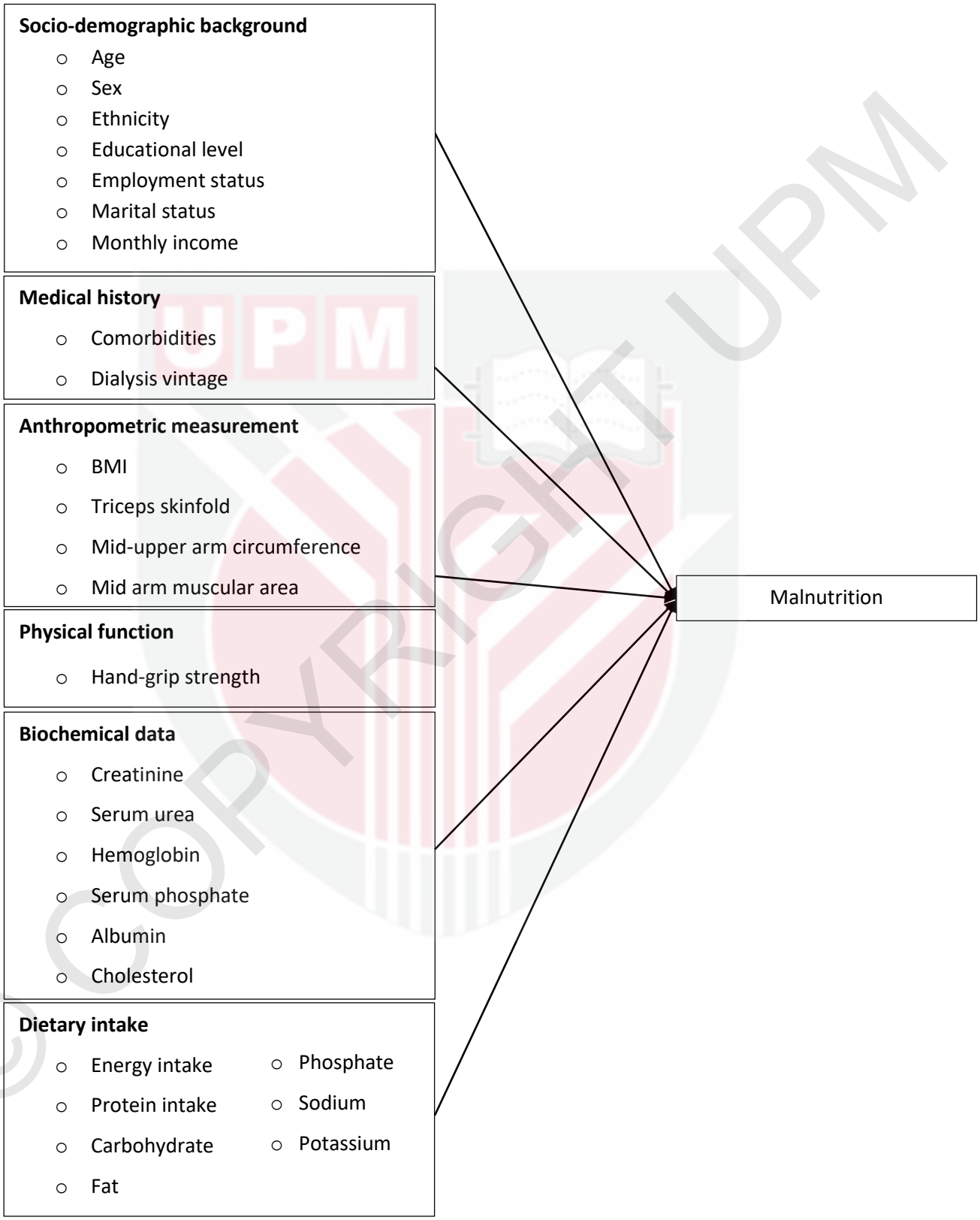
Specific Objectives

1. To determine the socio-demographic background (age, sex, ethnicity, educational level, and employment status), medical history (comorbidities and dialysis vintage), anthropometric measurement (BMI, triceps skinfold, mid-upper arm circumference, and mid-arm muscle area), physical function (hand-grip strength) biochemical data (creatinine, serum urea, hemoglobin, serum phosphate, albumin, and cholesterol), and dietary intake (energy intake, protein intake, carbohydrate, fat, phosphate, sodium, and potassium intake) among dialysis patients.
2. To determine the proportion of malnutrition among dialysis patients in Hospital Serdang and Hospital Kuala Lumpur.
3. To determine the association between socio-demographic background, medical history, anthropometric measurement, physical function biochemical data, and dietary intake among dialysis patients.

1.6 Hypothesis

There are no significant association between socio-demographic background, medical history, anthropometric measurement, physical function, biochemical data, and dietary intake with malnutrition status among dialysis patients in Hospital Serdang and Hospital Kuala Lumpur.

1.7 Conceptual Framework



CHAPTER 2

LITERATURE REVIEW

2.1 Chronic kidney disease

Chronic kidney disease (CKD) was defined as a decrease in kidney function or abnormalities of the kidney, with or without decreased GFR or GFR <60 mL/min/1.73m^2 for at least more than 3 months duration, regardless of the underlying cause (Inker et al., 2014). When the kidney gradually loss its function and reached its advanced stage, there will be an accumulation of fluid, electrolytes, and wastes in the body. Table 1 shows stages of CKD based on the GFR categories (Org et al., 2014).

Table 1: Glomerular filtration rate categories in chronic kidney disease

GFR Categories	GFR (mL/min/1.73m^2)	Terms
G1	≥90	Normal or high
G2	60-89	Mildly decreased*
G3a	45-59	Mildly to moderate decreased
G3b	30-44	Moderately to severe decreased
G4	15-29	Severely decreased
G5	<15	Kidney failure

*Relative to young adult level
Source: adapted from KDOQI 2014

GFR category G1 or G2 cannot be implemented for CKD criteria when there is no evidence of kidney damage.

2.2 Renal replacement therapy

When the kidneys loss its function or have progressed to end-stage kidney failure, it can lead to mortality. Thus, renal replacement therapy (RRT) is needed. There are three types of RRT, which are renal transplantation, hemodialysis, and peritoneal dialysis (Gilbert et al., 2018). The number of ESRD patients that undergo dialysis treatment in Malaysia is increasing for the past year (National Renal Registry, 2018). Hemodialysis is done by using a special filter that removes wastes and extra fluid from the body (Health, 2009). Most of these patients will required to go to a clinic for three times a week for 3 to 5 or more hours for each visit. Meanwhile, peritoneal dialysis is a daily dialysis treatment that can be performed at home. This is done by inserting dialysate fluid into the abdomen through a PD tube and will be left for several hours. The fluid inserted will collect wastes that have been filtered by the peritoneal membrane and later will be drained out from the body. There are two types of peritoneal dialysis which are automated peritoneal dialysis (APD) which requires the use of a machine called a cycler and continuous ambulatory peritoneal dialysis (CAPD) that use dialysate fluid to clean the blood and machine-free (National Kidney Foundation, 2019). Patients that undergo this treatment are freer to do daily activities, less fluid and dietary restriction and less medication needed.

2.3 Malnutrition

The American Society for Parental and Enteral Nutrition defined malnutrition as an imbalance between the requirement and intake of nutrients which lead to energy, protein, or micronutrient deficit that could adversely affect growth, development, and other related outcomes. The proportion of malnutrition among dialysis patients is very high and it is strongly

associated with increased risk of mortality, morbidity, and decreased quality of life (Khor et al., 2018; Krishnamoorthy et al., 2015; Wi & Kim, 2017). There are numerous factors that can contribute to the development of malnutrition in dialysis patients, including inadequate protein and calorie intake, loss of appetite, inflammation, loss of residual renal function, and inadequate dialysis (Wi & Kim, 2017).

2.4 Screening tools

There are many nutritional screening tools that can be used to detect malnutrition among dialysis patients such as subject global assessment (SGA), dialysis malnutrition score (DMS), and malnutrition inflammation score (MIS). SGA is a well-established tool to assess malnutrition among dialysis patients. However, it is less reliable and precise as its subjective evaluation and semi-quantitative scale only consist of three distinct severity levels (Harvinder et al., 2016). Another version of SGA which is DMS was developed and it is more precise and reliable compared to the previous tool (Kalantar-Zadeh et al., 1999). MIS then was developed with the addition of three other components which are BMI, serum albumin, and serum TIBC. Both DMS and MIS are useful in identifying dialysis patients that are at risk of getting malnutrition as they have sensitivity and accuracy above 50%. In this study, MIS was used as a tool to screen the patients as it has more advantages than DMS as it can reflect internal inflammation, predict hospitalization and mortality (Harvinder et al., 2016). Apart from that, MIS has better accuracy which is 74% as compared to DMS (61%) (Harvinder et al., 2016).

2.5 Socio-demographic background

Several studies indicate that there is no significant association between age and MIS among dialysis patients (Naeeni et al., 2017; Sohrabi et al., 2015). However, a study conducted in China shows a positive correlation between age and MIS among PD patients (Li et al., 2012). Moreover, in HD patients there is a correlation between age with MIS (Elsurer et al., 2008). However these studies did not highlight the correlation of other socio-demographic factors such as sex, ethnicity, educational level, employment status.

2.6 Medical history

The dialysis duration or dialysis vintage has no association with MIS among dialysis patients (Naeeni et al., 2017; Sohrabi et al., 2015). However, a study conducted by Chan et al. found a correlation between dialysis vintage and MIS, this is because longer dialysis vintage is associated with declined nutrition parameter (body composition and biochemical indicator)(Chertow et al., 2000). Meanwhile, there is no evidence for a correlation between comorbidities with MIS among PD patients in that study. Despite there is no correlation between comorbidities and MIS among PD patients but diabetes mellitus, hypertension, and cardiovascular disease become common comorbidities among HD and PD patients (Martins & Pecoits-filho, 2011).

2.7 Anthropometric measurement

BMI, Triceps skinfold (TSF), mid-arm circumference (MAC), and mid-arm muscle area (MAMA) are significantly associated with MIS among dialysis patients (Harvinder et al., 2016). Another study also found that BMI and mid-arm circumference is correlated with MIS among HD and PD

patients but no information regarding the correlation of TSF (Naeeni et al., 2017; Sahathevan et al., 2015). Thus, future research needs to be done to test the correlation between parameters in anthropometric measurement with MIS among dialysis patients.

2.8 Physical function

Reduced muscle mass is considered as one of the most important factors in the diagnosis of malnutrition, and handgrip strength (HGS) can be used as an efficient tool in assessing muscle function. A significant relationship is found between HGS with MIS (Bakkal et al., 2020). However, a study conducted by Sahathevan et al. in 2015 found no correlation between HGS with MIS.

2.9 Biochemical data

Serum creatinine, serum urea, albumin, and cholesterol are significantly correlated with MIS among dialysis patients (Harvinder et al., 2016). However, based on the study conducted by Naeeni et al. in 2017, they found that there is no correlation between serum creatinine, albumin, and cholesterol with MIS among PD patients. In malnourished dialysis patients, the level of serum albumin, serum creatinine, and prealbumin are decreased and the low levels of these nutritional markers are associated with increased mortality (Al-othman et al., 2016). Therefore, more studies related to the biochemical data with MIS among PD patients must be conducted to produce a constant outcome.

2.10 Dietary intake

Dietary intake plays a crucial part in determining the risk of getting malnutrition. Poor dietary intake among dialysis patients is associated with a decrease in energy and protein intake. There are multiple causes of poor dietary intake such as altered taste, restricted diet, and emotional distress (Rengin Elsurer & Afsar, 2010). This may due to the underlying mechanism of uremic metabolism in CKD that affects appetite and the intra-abdominal pressure from PD fluids that caused early satiety and poor dietary intake (Sahathevan et al., 2018). Based on the KDOQI guideline in 2019, the recommended dietary protein intake (DPI) for dialysis patients is 1.0 - 1.2 g/Kg/day. Meanwhile, the requirement of dietary energy intake (DEI) for dialysis patients is 25 – 35 Kcal/Kg/day. However, most of the dialysis patients have low DEI and DPI than the recommended intake (Jadeja & Kher, 2012). The study conducted by Harvinder et al, in 2016 shows there is no association between DEI and DPI with MIS among dialysis patients. There also no association found between carbohydrate and fat intake with MIS (Chen et al., 2013). As for the association between micronutrient intake (phosphate, sodium, and potassium) with MIS cannot be found due to limited study that tests this association.

CHAPTER 3

METHODOLOGY

3.1 Study design

The study designed used was a cross-sectional study that can analyzed data from a population or a group representative at a specific time.

3.2 Study location

This study was conducted at two government hospitals that have HD and CAPD clinics located in Klang Valley which were Hospital Serdang and Hospital Kuala Lumpur. These hospitals were chosen based on the convenient sampling method.

3.3 Sample size determination

Prevalence formula (Pourhoseingholi, 2013)

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Where,

n = sample size

Z = z value (1.96 for 95% confidence interval)

P = proportion of the target population estimated to have the characteristics from previous studies (0.90)

D = precision 10%

Correlation formula (Hulley at al., 2013)

$$N= [(Z\alpha+Z\beta)/ C]^2 + 3$$

$$C = 0.5*[(1+r)/(1-r)]$$

Where,

n= Calculated sample size

Z_α = the standard normal deviate for α, which is 1.960 at 95% confidence level

Z_β = the standard normal deviate for β, which is 0.842

r= Expected correlation coefficient

Table 3.1: Sample size calculation of the study

Prevalence or correlation study	Prevalence, p or Correlation, r	Sample size, n
Dialysis malnutrition and malnutrition inflammation score: screening tools for prediction of dialysis related protein energy wasting in Malaysia **(Harvinder et al., 2016)**	p = 0.9	n = $\frac{(1.96^2)\ 0.9\ (1-0.9)}{0.1^2}$ = 34
Correlation between Protein energy wasting by using Malnutrition Inflammation Score (MIS) with mid-upper arm circumference **(Harvinder et al., 2016)**	r= -0.333	n= $[(1.960+0.842)/ (-0.333)]^2 +3$ c= $0.5*ln\ [1+(-0.333)/ (1-(-0.333)]$ = 68

Extra 30% of the sample size was added to include for non-responsive or recording error. Thus, the required sample size was 68 + 30% of 68 = **97 respondents.**

3.4 Sampling design

The type of sampling method chosen for this study was convenience sampling which was a non-probability sampling method that relies on data collection from population members that were conveniently available to participate in this study. This method was chosen due to the application of convenience sampling was the easiest compared to other sampling methods and data collection can be facilitated in a short duration of time. Apart from that, this sampling method was commonly used as it was incredibly prompt, uncomplicated, and economical. Most researchers used convenience sampling in a situation where additional input was not required for the primary investigation. There were also no criteria required to be part of the study.

3.5 Respondents

The respondents for this study are dialysis patients in Hospital Serdang and Hospital Kuala Lumpur. The inclusion and exclusion criteria are as follow:

Table 3.2: Inclusion and Exclusion Criteria for Respondents

Inclusion criteria	Exclusion criteria
Adult age at least 18 years old	Diagnose with cognitive impairment such as dementia, Alzheimer and severe psychotic disorder
Undergoing dialysis at least 3 months	Involve in other intervention study and taking oral nutrition supplement (ONS)
	Hearing, vision & speech impairment

3.6 Study measures

Respondents were required to fill up the consent form and provide the information needed in the questionnaire. The questionnaire was divided into seven sections which were socio-demographic background, medical history, anthropometric measurement, physical function, biochemical data, and dietary intake, and malnutrition inflammation score. A detailed description of each measure in this study was listed below.

Socio-Demographic Background

Data for socio-demographic background such as age, sex, ethnicity, educational level, employment status, monthly income, and marital status was obtained through interviews.

Medical History

The researcher obtained information regarding medical histories which were comorbidities and dialysis vintage by reviewing the medical record.

Anthropometric Measurement

Most of the following anthropometric measurement was done according to the Anthropometry Procedures Manual published by the Center of Disease Control and Prevention (CDC) in 2007.

Height

Respondents that can stand still and unassisted can be assessed by standing height procedure by using a stadiometer with a fixed vertical backboard and an adjustable headpiece. Beforehand, respondents were required to remove any head accessories such as hair ornaments

or hair braided and bun from top of the head. Then, respondents were asked to stand up straight against the backboard with the even weight distribution, heels together and toes apart. Back of the head, shoulder blades, buttocks, and heels must be touched with the backboard. Next, the head needs to be aligned in the Frankfort horizontal plane and looks straight forward. Lastly, the stadiometer headpiece was lowered until it rests on top of the participants' head, with sufficient pressure to compress the hair and the reading was recorded with the nearest 0.1cm. This measurement was done by using a Seca portable stadiometer (SECA Model 220).

Weight

The dry weight of the respondents is determined clinically from the medical record.

Body mass index

Body mass index (BMI) was calculated by using the height and weight data of the respondents. BMI can be applied to male and female adults to measure their body fat. The formula used to calculate BMI was BMI = weight (kg)/ height $(m)^2$. Then, the weight status will be categorized based on the WHO (2000) cut-off points which comprised of underweight, normal, overweight, and obese.

Table 3.3: The International Classification of adult underweight, normal, overweight and obesity according to BMI

Classification	BMI cut-off point (Kg/m^2)
Underweight	<18.50
Normal	18.50-24.99
Overweight	25.00-29.99
Obese	≥30.00

Source: adapted from WHO, 2000, and WHO 2004.

Triceps skinfold

First, the respondents were asked to hang their arms loosely at the side with their shoulders relaxed. Next, a fold of skin and subcutaneous adipose tissue was grasped by using the thumb and index finger approximately 20 cm above the mid-upper arm circumference mark. The skinfold then holding 2.0 cm above the circumference mark and the tips of the caliper jaws were placed over the skinfold. The mark must remain centered between the tips and the caliper jaws need to be placed perpendicular to the length of the skinfold. Lastly, the caliper handles were released to exert a full tension on the skinfold and measurement can be taken after the needle on the caliper dial to settled. The reading was taken to the nearest 0.1mm by using a Harpenden skinfold caliper.

Mid-upper arm circumference

The respondents were required to stand upright with their right arm bent 90° at the elbow and shoulder relaxed. The length of the upper arm was measured by using the tape from the lateral tip of the acromion to the distal point on the olecranon. The measuring tape was then

placed between these two landmarks and the mid-point mark was obtained by dividing the measurement by two. Next, measuring tape was wrapped around the arm; level with the mid-point mark of the upper arm. The tape was positioned perpendicular to the long axis of the upper arm. The two ends of this tape were pulled together until it overlapped, so the zero ends placed below the measurement value. Lastly, the reading was taken to the nearest 0.1 cm with three readings and the mean was then being calculated.

Mid-arm muscle area

The measurement of MAMA was obtained by using the formula below:

$$\text{Male} = [\text{MAC (cm)} - \pi \times \text{TSF (cm)})^2/4\pi] - 10$$

$$\text{Female} = [\text{MAC (cm)} - \pi \times \text{TSF (cm)})^2/4\pi] - 6.5$$

Physical function

Handgrip strength was assessed by using Jamar handgrip dynamometer.

Hand-grip strength

Firstly, the grip handle was adjusted based on respondents' comfort and test requirement. Then, the [On/Off] key was pressed. [Select Test] key then was pressed based on respondents' dominant hand or hand without fistula (for HD patients) and the number of test repetitions was selected up to 3 repetitions. The respondents were later being asked to grasp the Jamar handgrip dynamometer and [test] key was pressed to start the test. The respondents were asked to

squeeze the grip and the result was recorded. The reading was taken to the nearest 0.1 cm with three readings and the mean was then being calculated.

Biochemical Data

Biochemical data were obtained by reviewing respondents' latest medical records such as renal profile (creatinine, serum urea, serum phosphate, albumin, and cholesterol) and hematology (hemoglobin).

Biochemical data	Normal Value
Creatinine (µmol/L)	44-132
Urea (mmol/L)	3.2-9.2
Serum phosphate (mmol/L)	1.13-1.78
Hemoglobin (g/dL)	10.0=12.0
Albumin (g/L)	≥40
Cholesterol (mmol/L)	3.9 – 5.2

Association of inflammatory biomarkers with sleep disorders in hemodialysis patients (2012)
Clinical Practice Guidelines Renal Replacement Therapy (Fourth Edition) (2007)
National Kidney Foundation Kidney Disease Outcomes Quality Initiative (K/DOQ1) Clinical Practice Guidelines for nutrition in chronic renal failure (2000)

3 Days Dietary Recall

Three days diet recall was assessed by interviewing the respondents their previous food intake (a day before), current day, and also during the weekend. Dietary recall during the weekend was asked through a phone call. For the portion size estimation, household measurements were used during the interview and detailed pieces of information regarding the foods and beverages taken were asked such as the amount of consumptions, brand names, cooking method, and types of food eaten. The foods estimated using the household measurement was converted into weight in gram. The data then were analyzed by using Nutritionist Pro version 4.0.0 to estimate the total energy and protein intake of the respondents. Energy and protein intakes were interpreted into respondents' ideal body weight. Respondents that were over and under-reported were excluded based on the energy intake to basal metabolic rate (EI: BMR) with the cut-off point <0.8 to >2.0 (Black, 2000). The adequacy of energy and protein intake then being compared with the dietary energy recommendation from KDOQI guidelines.

Table 3.4 The classification of energy and protein adequacy of dialysis patients

Classification	Cut-off points
Energy intake	
Below recommendation energy intake	<25 Kcal/Kg/day
Adequate energy intake	25 - 35 Kcal/Kg/day
Above recommendation energy intake	>35 Kcal/Kg/day
Protein Intake	
Below recommendation protein intake	<1.0 g/Kg/day
Adequate protein intake	1.0 – 1.2 g/Kg/day
Above recommendation protein intake	>1.2 g/Kg/day

Source: Adapted from KDOQI (2019)

Meanwhile, for Carbohydrate, fat, phosphate, sodium, and potassium it was classified based on MNT Guideline.

Table 3.5: The classification of energy and protein adequacy of PD patients

Dietary Intake	Recommendation
Carbohydrate	50-60% of energy intake
Fat	25-35% of energy intake
Phosphate	800-1000 mg
Sodium	2000-3000mg
Potassium	2500-3000mg

Source: Medical Nutrition Therapy for Chronic Kidney Disease (2005)

Nutritional Status

Malnutrition inflammation score (MIS) was used as a tool to determine nutritional status of dialysis patients. MIS questionnaire was divided into four sections which were medical history (changed in body weight, dietary intake, gastrointestinal symptoms, functional capacity, and comorbidities conditions), physical examination (decreased fat stores and signs of muscle wasting), body mass index and laboratory values (serum albumin level and serum transferrin level). Each component was scored between 0 (normal) to 3 (severely malnourished) and the total of all 10 components that range from 0 (normal) to 30 (severely abnormal) in which the higher scores indicate a more severe degree of malnourished and inflammation. The cut-off point ≥5 that indicates malnourished based on Harvinder et al. (2016) has been used to categorize the respondents into well-nourished or malnourished groups.

Weight change

The weight change of the respondents was calculated from the changes of dry weight for the past six months by reviewing the medical records. Score 0 was for weight loss that less than 0.5Kg or there is an increase in body weight. Score 1 indicates minor weight loss of at least 0.5Kg, but less than 1.0Kg. Score 2 was given for weight loss of at least 1.0Kg, but less than 5% of body weight and score 3 indicated weight loss of 5% or greater.

Dietary intake

Respondents were asked about their food intake and were scored into either of these scores:

i) good appetite with no recent changes or decreased in food intake (score 0),

ii) slightly suboptimal solid diet (score 1)

iii) moderate overall decrease to full liquid diet (score 2)

iv) hypo-caloric liquid to starvation (score 3).

GI symptoms

The respondents were scored 0 if no symptoms with a good appetite, score 1 if mild symptoms, poor appetite or nauseated occasionally, score 2 if occasional vomiting or moderate GI symptoms or score 3 if frequent diarrhea or vomiting or severe anorexia.

Functional capacity

Based on the interviewed respondents were scored based on score 0 if normal to improvised functional capacity, feeling fine, score 1 if occasional difficulty with baseline

ambulation, or feeling tired frequently, score 2 if difficulty with otherwise independent activities (e.g: going to bathroom) or score 3 if bed-ridden or little to no physical activity.

Co-morbidities

Respondents were assessed based on the number of years on dialysis and the co-morbidities in which on dialysis less than one year and healthy were score as 0, dialyzed for 1-4 years or mild co-morbidity were score as 1, dialyzed >4 years or moderate co-morbidity were scores as 2 and any severe, multiple co-morbidity were score as 3.

Body fat stores

It was scored by assessing the loss of subcutaneous fat at four main parts which were under eyes, triceps, biceps, and chest. The result was scored into either 0 (normal or no change), 1 (mild), 2 (moderate), or 3 (severe) according to SGA criteria.

Signs of muscle wasting

The scoring was done by observing seven major sites on the body which were temple, clavicle, scapula, ribs, quadriceps, knee, and interosseous. The resulted were score based on the SGA criteria which were 0 to 3 (normal to severe).

BMI

The value was obtained from the anthropometric measurements and were score based on score 0 for BMI ≥ 20 kg/m^2, score 1 for BMI 18-19.99 kg/m^2, score 2 for BMI 16-17.99 kg/m^2, or score 3 for BMI ≤ 16 kg/m^2.

Serum albumin

The data was obtained from the latest medical record and was scored into score 0 if albumin was less than 4.0 d/dL, score 1 if albumin was between 3.5-3.9 g/dL, score 2 if albumin was between 3.0-3.4 g/dL or score 3 if albumin was lesser than 3.0 g/dL.

Serum TIBC

The latest value of biochemical data from medical history was reviewed and scored into score 0 if TIBC was more than 200 mg/dL, score 1 if TIBC was between 200-249 mg/dL, score 2 if TIBC was between 150-199 mg/dL or score 3 if TIBC was lesser than 150 mg/dL.

3.7 Pre-testing

About 10% of the total sample size, that meets the study criteria was used to do the pre-testing. Pre-testing was done for stimulating of formal data collection process on a small scale to identify any practical issues concerning the instruments, sessions, and methodology used (Hurst et al., 2015). A revision of study materials and data collection can be done by pre-testing which was to ensure that appropriate questions are being asked and the questions will not cause any confusion or uncomfortable session to the respondents. It was important to do pre-testing as it can estimate time length used to finish all the questionnaires and maximizing the personnel methodological skill in the data collection procedure. Apart from that, pre-testing can also be used to assess the viability and accuracy of the questionnaire translation and transcription protocols in preparing the interview text and questionnaires. Any issues that arise during the pre-testing have been solved before the formal data collection started.

3.8 Procedure

Ethical approval was obtained from the Medical Research & Ethics Committee (MREC) (NMRR-19-2501-50205) and approval from Hospital Serdang prior to the formal data collection. When the approval has been obtained, pre-testing was carried out to test the accuracy and viability of the questionnaire used. During data collection, information sheets regarding the purpose of the study and consent form were given before the questionnaire been asked. The questionnaire was in the form of the interviewer-administered questionnaire, where the researcher had an interview about the socio-demographic background, dietary intake, and some components in the malnutrition inflammation score. Anthropometric measurements such as triceps skinfold, mid-arm circumference, mid-arm muscle area, handgrip strength, and part of malnutrition inflammation score such as BMI were assessed by the researcher. Meanwhile, data for medical history such as comorbidities and biochemical data such as creatinine was obtained from medical records. A Phone call interview was carried out for the remaining diet recall during the weekend.

3.9 Data analysis

All the data collected was analyzed using IBM Statistics SPSS 25.0. The statistical analysis for all tests was set at $p<0.05$. A normality test was done to check the normality of the data. Descriptive analysis was used to analyze two types of variables which were categorical variables in the form of frequencies and percentages and the continuous variable used to find the mean and standard deviation (normally distributed) or median and IQR (non-normally distributed).

Meanwhile, Pearson and Spearman's product-moment correlation was used to test the correlation between continuous variables. Chi-square test of independence and Mann-Whitney U test was used to test the correlation between categorical variables and independent t-test (t) was used to compare the differences between two continuous variables.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presented the findings of this study that aimed to assess malnutrition in dialysis patients in Hospital Serdang and Hospital Kuala Lumpur. There were 97 dialysis patients initially identified and 82 were recruited in this study (response rate of 85%), where 56 and 26 respondents were Hemodialysis and Peritoneal dialysis patients respectively.

4.2 Socio-demographic background of the respondents

The total number of respondents that participated in this study was 82 respondents, which consist of 51.2% male and 48.8% female. The median age of respondents was 57 years old. Table 4.1 below shows the socio-demographic background of the respondents. Based on the study conducted by Harvinder et al. in 2016, the mean age was 52 years old and male respondents were more compared to female respondents.

Majority of the respondents were Malay (52.4%), while the remaining were Chinese (32.9%) and Indian (14.6%). Based on the educational level, respondents that had no education or primary education were 31.7%, while respondents that had secondary and college and university education level were 68.3%. On the other hand, about 8 in 10 of the respondents were married while the remaining was single.

For employment status, most of the respondents were unemployed (73.2%) while the remaining 26.8% were employed. In terms of monthly household income, the majority (85.4%) of the respondents had less than RM2000 income which constituent of <Rm 500, RM 1000-RM

2000. In contrast, 14.6% of respondents had, monthly household income more than RM2000 that include respondents that had RM 2001- RM 3000, RM 3001 – RM 4000, RM4000 – RM5000, or > RM5000, monthly.

Table 4.1: Socio-demographic background of the respondents (n=82)

Variable	n (%) or median (IQR)	Mean ± SD
Age	57 (18.25) [a]	53.28 ± 57.00
Sex		
Male	42 (51.2)	
Female	40 (48.8)	
Ethnicity		
Malay	43 (52.4)	
Chinese	27 (32.9)	
Indian	12 (14.6)	
Education Level		
No education	2 (2.4)	
Primary school	24 (29.3)	
Secondary school	37 (45.1)	
College/university	19 (23.2)	
Marital Status		
Single	16 (19.5)	
Married	66 (80.5)	
Employment Status		
Employed	22 (26.8)	
Unemployed	60 (73.2)	
Monthly Household Income		
<RM500	32 (39.0)	
RM500-1000	15 (18.3)	
RM1001-2000	23 (28.0)	
RM2001-3000	4 (4.9)	
RM3001-4000	3 (3.7)	
RM4001-5000	2 (2.4)	
>RM5000	3 (3.7)	

[a] Express in median (IQR)

4.3 Medical history of the respondents

Table 4.2 shows the median of dialysis vintage of the respondents was 41months. The comorbidities among respondents were shown in Figure 4.1. Based on the diagram, most of the respondents were having hypertension (51%), followed by diabetes mellitus (22%) and hyperlipidemia (19%). On the other hand, 8% of the respondents were having cardiovascular disease. The duration of dialysis was longer while the presence of comorbidities were comparable to an earlier local study (Chan et al., 2019).

Table 4.2: Medical history of the respondents (n=82)

Variable	Median (IQR)	Mean ± SD
Dialysis vintage	41 (62.75)	62.34 ± 58.44

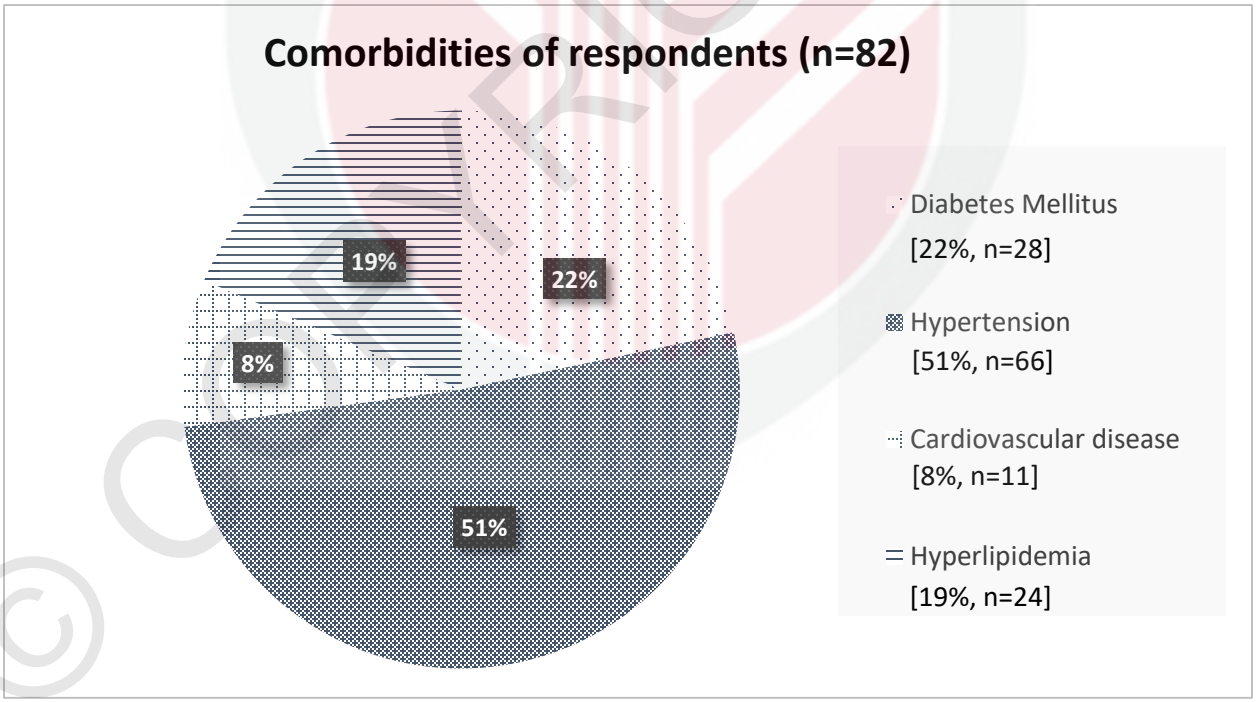


Figure 4.1: Presence of comorbidities among respondents (n=82)

4.4 Anthropometry measurements of the respondents

Table 4.3 shows anthropometry measurement of the respondents which were BMI, triceps skinfold (TSF) mid-upper arm circumference (MUAC), and mid-arm muscle area (MAMA). The median value for BMI, TSF, and MUAC was 24.10 Kg/m^2, 16.75 mm, and 27.55 cm respectively. These results were found to be consistent with the finding from Kalantar-Zadeh et al. in 2001, in which the mean value for BMI, TSF, and MUAC was 24.7 Kg/m^2, 14.7 mm and 26.6 cm respectively. Meanwhile, the mean value for MAMA was 30.30 ± 29.36 cm^2.

Table 4.3: Anthropometry measurements of the respondents (n=82)

Variable	Median (IQR)	Mean ± SD
BMI (Kg/m^2)	24.10 (7.03)	
Triceps skinfolds (mm)	16.75 (10.80)	
Mid-upper arm circumference (cm)	27.55 (4.83)	
Mid-arm muscle area (cm^2)		30.30 ± 29.36

4.5 Physical function of the respondents

Table 4.4 below shows a result for physical function, in which the median value for HGS was 18.40 (9.35) Kg. Another study reported that the mean for HGS was 16.91 ± 7.79 Kg, however, this study focuses on hemodialysis patients only (Sahathevan et al., 2015).

Table 4.4: Physical function of the respondents (n=82)

Variable	Median (IQR)
Handgrip strength (Kg)	18.40 (9.35)

4.6 Biochemical data of the respondents

According to the table below, the median value of creatinine was 983.50 µmol/L with a wide range of 363 – 11567 µmol/L. All of the respondents had a high creatinine level which was more than 115 µmol/L. As for the median value of serum urea, it was 17.44 mmol/L. Meanwhile, majority of the respondents (82.9%) had an abnormal level of hemoglobin with the remaining 17.1% had a normal level of hemoglobin. The median value of hemoglobin was 10.80 g/dL.

About 65% of the respondents had an abnormal level of phosphate, followed by 34.1% of respondents had normal phosphate level. The mean value of phosphate was 1.8 ± 0.58 mmol/L. Apart from that, almost all of the respondents had low albumin levels with a median value of 37.14 g/L. As for the cholesterol level, respondents that had abnormal and normal value were equal. The mean value of cholesterol was 4.5 ± 1.06 mmol/L. There were also study that had similar results in which creatinine and urea were found to be high among hemodialysis patients and low albumin and hemoglobin level (Sahathevan et al., 2015). Creatinine was derived from skeletal muscle which can be used as a biomarker of somatic body protein (Park et al., 2013). Increase creatinine level has been associated with better survival, while low creatinine level has been associated with increase mortality. This to be said that, creatinine can reflects muscle mass and low muscle mass resulting from malnutrition can be associated with poor outcome in dialysis patients (Park et al., 2013). As for the high level of urea,

Table 4.5: Biochemical data of the respondents (n=82)

Variable	Median (IQR)	Mean ± SD or n (%)	Range
Creatinine (µmol/L)	983.50 (359.0)		62-115
Urea (mmol/L)	17.44 (5.55)		3.2 – 9.2
Hemoglobin (g/dL) [a]	10.80 (2.03)		10.0 – 12.0
Normal		14 (17.1)	
Abnormal		68 (82.9)	
Phosphate (mmol/L) [b]		1.8 ± 0.58	1.13 – 1.78
Normal		28 (34.1)	
Abnormal		54 (65.9)	
Albumin (g/L) [c]	37.14 (8.00)		≥40
Normal		5 (6.1)	
Abnormal		77 (93.9)	
Cholesterol (mmol/L) [c]		4.5 ± 1.06	3.9 – 5.2
Normal		41 (50.0)	
Abnormal		41 (50.0)	

[a] Association of inflammatory biomarkers with sleep disorders in hemodialysis patients (2012)
[b] Clinical Practice Guidelines Renal Replacement Therapy (Fourth Edition) (2007)
[c] National Kidney Foundation Kidney Disease Outcomes Quality Initiative (K/DOQ1) Clinical Practice Guidelines for nutrition in chronic renal failure (2000)

4.7 Dietary intake of the respondents

Out of 82 respondents, 12 of them were found to misreport their dietary intake based on the energy intake to basal metabolic rate (EI: BMR) with the cut-off point <0.8 to >2.0 (Black, 2000). Harris-Benedict equation was used to estimate the basal metabolic rate of the patients. Thus, these respondent's dietary data were not included in the result below.

The median value for the energy intake of the respondents was 1397 Kcal and 24.80 Kcal/Kg IBW/day. More than half of the respondents did not meet the energy intake recommendation based on the KDOQI guideline, which half of them had lower than the recommendation and 10% of the respondents had above than the recommendation. The

median value for protein intake was 49.95 g or 0.90 g/Kg/day. About 8 in 10 of the respondents failed to meet the protein recommendation (1.2 – 1.3 g/Kg/day) based on the KDOQI guideline, in which only 14.3% of the respondents were within the recommendation. Other studies found most of the patients did not meet the recommended energy and protein intake based on the KDOQI guideline (Chan et al., 2019; Sahathevan et al., 2015).

Meanwhile, for carbohydrate and fat, the median values were 184.82 g/day and 43.98 g/day respectively. On the other hand, for phosphate intake, only 11.4% of the respondents that were within recommendation which is between 800 – 1000 mg/day, while the remaining 90% of the respondents not meeting the recommendation. Besides, about 3/10 of the respondents had sodium intake within the recommendation, while another 70% not meeting the recommendation. The median value for phosphate, sodium, and potassium was 933.06 mg/day, 2218.23 mg/day, and 933.06 mg/day respectively.

Table 4.6: Dietary intake of the respondents (n=70)

Variables	Median (IQR)	Below recommendation	Within recommendation	Above recommendation
Energy intake (kcal)	1397 (397)			
Dietary Energy intake (kcal/kg IBW/day)	24.80 (7.30)	37 (52.9)	26 (37.1)	7 (10.0)
Protein intake (g)	49.95 (21.63)			
Dietary Protein intake (g/Kg IBW/day)	0.90 (0.34)	50 (71.4)	10 (14.3)	10 (14.3)
Carbohydrate intake (g/day)	184.82 (64.20)			
Fat intake (g/day)	43.98 (24.62)			
Phosphate intake (mg/day)	933.06 (605.43)	57 (81.4)	8 (11.4)	5 (7.1)
Sodium intake (mg/day)	2218.23 (1529.94)	30 (42.9)	22 (31.4)	18 (25.7)
Potassium (mg/day)	933.06 (605.43)	82(100)		

Note: Energy and protein intake were classified based on KDOQI guidelines (KDOQI, 2019), while phosphate and sodium intake based on Medical Nutrition Therapy Guidelines for Chronic Kidney Disease (2005).
Energy (kcal/kg IBW/day): Below recommendation: < 25 Kcal/kg IBW/day, Within recommendation: 25 – 35 Kcal/Kg IBW/day, Above recommendation: >35 Kcal/kg IBW/day
Protein (g/IBW Kg/day): Below recommendation: <1.0 g/kg IBW/day, within recommendation: 1.0 – 1.2 g/Kg IBW/day, above recommendation: >1.2 g/kg IBW/day
Phosphate (mg/day): below recommendation: <800 mg/day, within recommendation: 800-1000 mg/day, above recommendation: >1000 mg/day
Sodium (mg/day): below recommendation: <2000 mg/day, within recommendation: 2000-3000 mg/day, above recommendation: >3000 mg/day
Potassium (mg/day): below recommendation: <2500 mg/day, within recommendation: 2500-3000 mg/day, above recommendation: >3000 mg/day

4.8 Malnutrition inflammation score of the respondents

Malnutrition was examined by using malnutrition inflammation score (MIS) with the cut-off points <5 as normal and ≥5 as malnourished. When the cut-off point was applied, more than half of the respondents were malnourished, while the remaining 45% of the respondents were well-nourished, with 53.6% from a total of HD and 57.7% from a total of PD patients were malnourished. Other study found that 88% of HD patients and 90% of PD patients were malnourished (Harvinder et al., 2016). The huge percent of difference might due to the bigger sample size used by that study which was 155 HD and 90 PD patients.

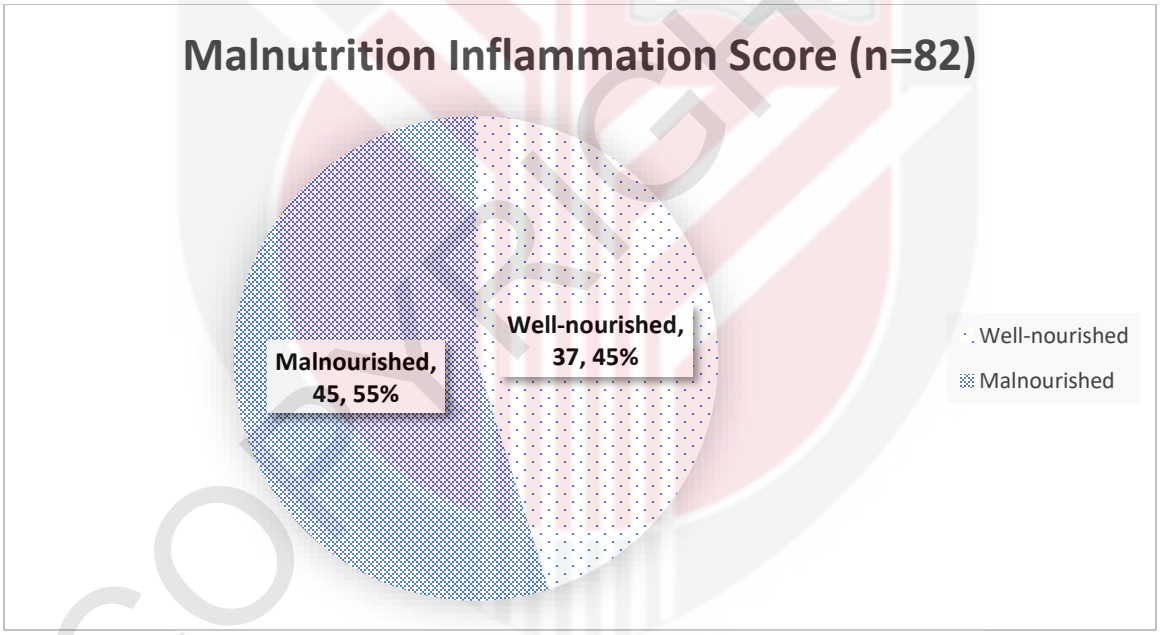


Figure 4.2: Malnutrition inflammation score category (n=82)

Table 4.7: Malnutrition inflammation score of respondents (n=82)

Variable	Dialysis modality	
	HD (n=56)	PD (n=26)
Malnutrition Inflammation Score	1.0 (1.0) [a]	1.0 (1.0)
Well-nourished (<5) [n (%)]	26 (31.7)	11 (13.4)
Malnutrition (≥5) [n (%)]	30 (36.6)	15 (18.3)

[a] Express as median (IQR).

4.9 Hypothesis testing

Based on table 4.8, Chi-square Test showed that there was no significant association between dialysis modality and MIS (p>0.05).

Table 4.8: Association between dialysis modality with MIS (n=82)

Variable	MIS		χ^2	*p*
	Well-nourished (n=37)	Malnourished (n=45)		
Dialysis modality				
HD	26 (31.7)	11 (13.4)	.122	.727
PD	30 (36.6)	15 (18.3)		

a) There is no significant association between socio-demographic characteristics with MIS among dialysis patients in Hospital Serdang and Hospital Kuala Lumpur.

A Mann-Whitney U test has been conducted for age, where there is no significant association between age and MIS (p>0.05). While other socio-demographic background, which was sex, ethnicity, educational level marital status, employment status, and monthly household income also showed no significant association with MIS (p>0.05). Thus, this result revealed that protein-energy wasting was not influenced by socio-demographic background among dialysis patients. Therefore, the null hypothesis, there was no significant association between socio-demographic background with MIS among dialysis patients, was failed to be rejected.

Table 4.9: Association between socio-demographic background with MIS (n=82)

Variable	MIS		χ^2 or z-score	*p*
	Well-nourished (n=37)	Malnourished (n=45)		
Age (years)	50 (21.0)	58 (17.0)	-1.679[d]	.093
Sex				
Male	23 (28.0)	19 (23.2)	3.231	.072
Female	14 (17.1)	26 (31.7)		
Ethnicity				
Malay	17 (20.7)	26 (31.7)	1.140	.286
Non-Malay	20 (24.4)	19 (23.2)		
Education level				
<Secondary	11 (13.4)	15 (18.3)	.122	.727
≥Secondary	26 (31.7)	30 (36.6)		
Marital status				
Single	10 (12.2)	6 (7.3)	2.424	.119
Married	27 (32.9)	39 (47.6)		
Employment status				
Employed	12 (14.6)	10 (12.2)	1.078	.299
Unemployed	25 (30.5)	35 (42.7)		
Monthly income				
≤RM2000	33 (40.2)	37 (45.1)	.789	.374
>RM2000	4 (4.9)	8 (9.8)		

[d] Mann-Whitney U Test used to compare the difference between a well-nourished and malnourished group.

There was no association between age, sex, ethnicity, educational level, marital status, and employment status with MIS (Namuyimbwa et al., 2018; Sahathevan et al., 2015). However, based on a study conducted by Wi and Kim in 2017, they found that there was an association between age with MIS. This may due to the aging process, in which fat-free mass (FFM) that comprises of muscle, organ tissue, skin, and bone had shown to decrease with age, beginning at an earlier age than fat mass loss, around 40-50 years (Ponti et al., 2020). The body's muscle content is important due to the relation between muscle mass and physical function, strength, and morbidity (Hickson, 2006). Apart from that, a previous study found that there was an

association between monthly income with MIS (Sahathevan et al., 2015). Most people that have low-income status, low levels of education with limited access to a good medical facility leading to a negative effect on health status. These factors also influence the purchasing power and improve nutritional status (Aggarwal et al., 2019).

b) There is no significant association between medical history with MIS among dialysis patients in Hospital Serdang and Hospital Kuala Lumpur.

According to Table 4.10, Mann-Whitney U Test found that there was no significant association found between dialysis vintage with MIS ($p>0.05$). The same result also applied for the comorbidities (diabetes mellitus, hypertension, hyperlipidemia, and cardiovascular disease) after the Chi-square test been conducted for this variable. Hence, the null hypothesis, there was no significant association between medical history with MIS among dialysis patients, was failed to be rejected.

Table 4.10: Association between medical history with MIS (n=82)

Variable	MIS		χ^2 and z-score	*p*
	Well-nourished (n=37)	Malnourished (n=45)		
Dialysis vintage (months)	38 (44.2)	46 (65.5)	-1.361[d]	.174
Comorbidities				
Diabetes mellitus				
Yes	13 (15.9)	15 (18.3)	.029	.864
No	24 (29.3)	30 (36.6)		
hypertension				
Yes	31 (37.8)	35 (42.7)	.466	.495
No	6 (7.3)	10 (12.2)		
Hyperlipidemia				
Yes	9 (11.0)	15 (18.3)	.769	.372

No	28 (34.1)	30 (36.6)		
Cardiovascular disease				
Yes	5 (6.1)	6 (7.3)	.001	.981
No	32 (39.0)	39 (47.6)		

[d] Mann-Whitney U Test used to compare the difference between a well-nourished and malnourished group.

This study was consistent with Kalantar-Zadeh et al. (2001) and Namuyimbwa et al. (2018), regarding the association between dialysis vintage, diabetes mellitus, hypertension, hyperlipidemia, and cardiovascular disease with MIS. However, there was a study that found association between MIS and dialysis vintage (Chan et al., 2019). Dialysis vintage is related to the nutritional status and it is associated with a significant decrease in all nutritional parameters. Apart from that, a year spent on dialysis is correlated with the 6% increase in the risk of death (Chertow et al., 2000).

c) There is a significant correlation between anthropometry data with MIS among dialysis patients in Hospital Serdang and Hospital Kuala Lumpur.

A Spearman Rank Correlation test was conducted as shown in Table 4.11 and there was no significant correlation found for BMI and TSF with MIS ($p>0.05$). However, there was a negative significant correlation found for MUAC with MIS ($P<0.05$). As for the Pearson Correlation Coefficient test that has been conducted for MAMA, there was also no significant correlation between MAMA and MIS ($p>0.05$). Thus, the third hypothesis which was there was no significant relationship between anthropometry data with MIS, was rejected.

Table 4.11: Correlation between anthropometry data with MIS (n=82)

Variable	MIS	
	r	***p***
BMI (Kg/m^2)	-.080 [a]	.474
TSF (mm)	-.126 [a]	.259
MUAC (cm)	-.228 [a]	.040*
MAMA (cm^2)	-.165	.139

[a] Spearman Rank Correlation Coefficient Test used to determine the relationship between two non-continuous variables.
**p*= <0.050

The result of this study was not consistent with the finding by Sahathevan et al. (2015), where they also found correlations between BMI, TSF, and MAMA with MIS. While BMI is widely used in measuring adiposity in the general population, it may be an inaccurate indicator of nutritional status, particularly among dialysis patients since it does not differentiate between muscle mass and fat as well as the distribution of body fats (Kittiskulnam & Eiam-Ong, 2018). Moreover, the functional significance of BMI may be altered by factors such as age and the presence of edema. This is because adults tend to lose fat-free mass and increase fat mass and they also may develop edema which artificially increases the person's weight. As for MAMA, it has shown that the error in estimating MAMA in elderly people was two to three times greater than in young people, and this error may cause by the increased adiposity due to muscle atrophy during aging (Saito et al., 2010).

d) There is no significant correlation between a physical function with MIS among dialysis patients in Hospital Serdang and Hospital Kuala Lumpur.

Based on the Spearman Rank Correlation test for HGS, there was no correlation found between HGS with MIS. Thus, the hypothesis which was there was no significant relationship between anthropometry data with MIS, failed to be rejected.

Table 4.12: Correlation between physical function with MIS (n=82)

Variable	MIS	
	rho	***p***
HGS (Kg)	-.214	.053

There was no correlation found between HGS with MIS, this outcome was consistent with a study conducted by Sahathevan et al. in 2015. However, significant relationship is found between HGS with MIS (Bakkal et al., 2020). Handgrip strength has been associated with muscle mass, which correlates with deterioration in elderly nutritional status. This is due to the aging process, which showed a decrease in fat-free mass (comprise of muscle, organ tissue, skin, and bone) with age (Ponti et al., 2020).

e) There is a significant correlation between biochemical data with MIS among dialysis patients in Hospital Serdang and Hospital Kuala Lumpur.

Table 4.13 shows a Spearman Rank Correlation Coefficient test was used to determine the correlation between creatinine, urea, hemoglobin, and albumin. Based on the result, it is shown that there was a negative significant relationship between creatinine, urea, and albumin with MIS ($p<0.05$). As for the Pearson Correlation Coefficient test conducted on phosphate and cholesterol, there was a significant relationship between phosphate and MIS ($p<0.05$). However, there was a significant relationship between cholesterol with MIS ($p>0.05$). Thus, the null hypothesis, there was no significant relationship between biochemical data with MIS among dialysis patients, was rejected except for hemoglobin and cholesterol.

Table 4.13: Correlation between biochemical data with MIS (n=82)

Variable	MIS	
	r	***p***
Creatinine (µmol/L)	-.263 [a]	.017*
Urea (mmol/L)	-.252 [a]	.022*
Hemoglobin(g/dL)	-.035 [a]	.758
Phosphate (mmol/L)	-.237	.032*
Albumin (g/L)	-.366 [a]	.001*
Cholesterol (mmol/L)	-.117	.295

[a] Spearman Rank Correlation Coefficient Test used to determine the relationship between two non-continuous variables
*p= <0.050

There was consistent finding with other studies done by Harvinder et al. in 2016 and Ebrahimzadehkor et al. in 2014 except for phosphate. A low albumin level was a strong predictor of poor outcome and mortality (Jadeja & Kher, 2012). Albumin had been used as a clinically reliable measure of malnutrition in patients, with the increase of age, the concentration of serum

albumin also decrease by 0.1 g/L per year (Keller, 2019). Apart from that, its pool can be impaired by a variety of inflammatory conditions and medication, especially those affecting liver function (Bharadwaj et al., 2016). Hyperphosphatemia poses a major risk in patients with dialysis. Wide clinical studies have shown an association between serum phosphate levels in patients that undergo dialysis and all-cause mortality (Jadeja & Kher, 2012). Moreover, Phosphate was found to have a close relationship with protein intake where lower serum phosphate is associated with low protein intake. As for hemoglobin, low hemoglobin levels associated with anemia where anemia has shown to be a marker for malnutrition in dialysis patients (Kadiri et al., 2011).

f) There is a significant correlation between dietary intake with MIS among dialysis patients in Hospital Serdang and Hospital Kuala Lumpur.

A Spearman Rank Correlation Coefficient test was shown in Table 4.14 and there were no significant relationship dietary intake variables with MIS ($p>0.05$). However, there was a significant relationship between protein intake (g/day) with MIS ($p<0.5$). Hence, the last hypothesis, there was no significant relationship between dietary intake with MIS among dialysis patients, was rejected.

Table 4.14: Correlation between dietary intake with MIS (n=70)

Variable	MIS	
	rho	***p***
Energy intake (kcal/day)	-.118	.333
Dietary Energy intake (kcal/kg IBW/day)	-.068	.577
Protein intake (g/day)	-.263	.026*
Dietary Protein intake (g/kg IBW/day)	-.166	.170
Carbohydrate intake (g/day)	-.172	.153
Fat intake (g/day)	-.002	.988

Phosphate intake (mg/day)	-.152	.208
Sodium intake (mg/day)	-.127	.294
Potassium (mg/day)	-.120	.322

**p*= <0.050

There was consistent finding found in Chen et al. (2013) with this study, where there was no correlation between dietary intake with MIS except for protein intake. Other studies also found a similar result in which energy intake (Kcal/day)and protein intake (g/day) do not correlate with MIS (Harvinder et al., 2016). However, in this study protein intake was found to correlate with MIS. Inadequate protein intake was found to be correlated with mortality (Jadeja & Kher, 2012). Most of the patients had below than recommendation. This may due to the patients that want to restrict dietary phosphorus. Dietary phosphorus strongly correlates with the total protein content, thus limiting the dietary phosphorus lead to low protein consumption (Sarav & Kovesdy, 2018). Educating patients about food choice for high protein and low phosphorus, cooking methods to eliminate phosphorus from food, and promoting the use of phosphorus binders can help in the consumption of protein (Sarav & Kovesdy, 2018).

Intake of dietary micronutrients such as sodium and phosphate has always been a major concern in dialysis patients. Dietary sodium restriction, typically used in PD patients helps to prevent water accumulation and high blood pressure. Meanwhile, very low sodium intake has been associated with an increased risk of general and cardiovascular death in PD patients (Martín-del-Campo et al., 2012).

CHAPTER 5

5.1 Conclusion

Regular monitoring of malnutrition among dialysis patients is important to lower the risk of mortality and morbidity among them. In this study, it is found that more than half of the respondents were malnourished, while 45% were either at risk of malnourished or well-nourished according to the malnutrition inflammation score (MIS). Mid-upper arm circumference, creatinine, urea, phosphate, albumin, and protein intake were found to be associated with MIS among dialysis patients in Hospital Serdang and Hospital Kuala Lumpur. Meanwhile, socio-demographic background, medical history, and other variables that have not been stated before have no association with MIS among dialysis patients. Hence, identification and management of malnutrition in these patients are important to improve their survival and quality of life.

5.2 Limitation of the study

Patients that have been recruited for this study only represent a small portion of the dialysis spectrum and patients from Hospital Serdang and HKL only. Thus, it cannot be used to generalized for a large population. Apart from that, the sample size obtained (n=82) are not achieving the target sample size, but only achieving the minimum sample size due to the time restriction. However, this minimum sample size cannot be used to test the hypothesis testing and only suitable to determine the prevalence of the study. Moreover, diet recall might cause biased as it relays on respondents' memories which can lead to misreporting.

5.3 Recommendation of the study

In order to represent the whole population of dialysis patients in Malaysia, a large sample size should be used. It can also increase the validity of the study. Apart from that, large sample size can also help in represent a larger population compared with a single site study. Moreover, for the sampling method, it is better to use simple random sampling instead of convenience sampling. This is due to its purest and most straightforward probability sampling strategy. It is also because of the equal probability of each member of the population to be likely been chosen as part of the study and to remove any bias from the selection procedure. Moreover, the end result can potentially be used for representing the larger group as a whole. Furthermore, a food-frequency questionnaire can be used to assess the dietary intake of the respondents as it can minimize the biased.

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APPENDICES

JAWATANKUASA ETIKA & PENYELIDIKAN PERUBATAN
(*Medical Research & Ethics Committee*)
KEMENTERIAN KESIHATAN MALAYSIA
d/a Kompleks Institut Kesihatan Negara
Blok A, No 1, Jalan Setia Murni U13/52,
Seksyen U13, Bandar Setia Alam,
40170 Shah Alam, Selangor. Tel: 03-3362 8888/8205

Ref : KKM/NIHSEC/ P19-2107 (6)
Date: 27- September -2019

Dr Nor Fadhlina binti Zakaria
UNIVERSITY PUTRA MALAYSIA (UPM)

Dr Zulfitri 'Azuan Bin Mat Daud
UNIVERSITY PUTRA MALAYSIA (UPM)

Dear Sir/ Mdm,

ETHICS INITIAL APPROVAL: NMRR-19-2501-50205 (IIR)
Assessing Protein Energy Wasting Among Malaysian Dialysis Patients Using Bio-electrical Impedance Analysis-Derived Phase Angle

This letter is made in reference to the above matter.

2. The Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia (MOH) has provided ethical approval for this study. Please take note that all records and data are to be kept strictly **CONFIDENTIAL** and can only be used for the purpose of this study. All precautions are to be taken to maintain data confidentiality. Permission from the District Health Officer / Hospital Administrator / Hospital Director and all relevant heads of departments / units where the study will be carried out must be obtained prior to the study. You are required to follow and comply with their decision and all other relevant regulations, including the Access to Biological and Benefit Sharing Act 2017.

3. The investigators and study sites involved in this study are:

   HOSPITAL KUALA LUMPUR
   Dr Nor Fadhlina binti Zakaria (Penyelidik Utama)
   Dr Zulfitri 'Azuan Bin Mat Daud (Penyelidik Utama)

   HOSPITAL SERDANG
   Dr Nor Fadhlina binti Zakaria (Penyelidik Utama)
   Dr Zulfitri 'Azuan Bin Mat Daud (Penyelidik Utama)

4. The following study documents have been received and reviewed with reference to the above study:

Documents received and reviewed with reference to the above study:

1. Study Protocol_Version 2, dated 18 -September- 2019
2. Patient information sheet (English) & Informed Consent Form (English) Version 1, dated 28 - August- 2019
3. Patient information sheet (Malay) & Informed Consent Form (Malay) Version 1, dated 28 - August- 2019
4. Questionnaire Version 1, dated 28 -August- 2019
5. Investigator's documents : Declaration of Conflict of Interest (COI), IA-HOD-IA, and CV:
   a) Dr Nor Fadhlina binti Zakaria (Penyelidik Utama)
   b) Dr Zulfitri 'Azuan Bin Mat Daud (Penyelidik Utama)

JAWATANKUASA ETIKA & PENYELIDIKAN PERUBATAN
(*Medical Research & Ethics Committee*)
KEMENTERIAN KESIHATAN MALAYSIA
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Blok A, No 1, Jalan Setia Murni U13/52,
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Ruj.Kami: KKM/NIHSEC/ P19-2107 (7)
Tarikh : 27-September-2019

Dr Nor Fadhlina binti Zakaria
UNIVERSITY PUTRA MALAYSIA (UPM)

Dr Zulfitri 'Azuan Bin Mat Daud
UNIVERSITY PUTRA MALAYSIA (UPM)

Dato'/ Tuan/ Puan,

SURAT KELULUSAN ETIKA: NMRR-19-2501-50205 (IIR)
Assessing Protein Energy Wasting Among Malaysian Dialysis Patients Using Bio-electrical Impedance Analysis-Derived Phase Angle

Dengan hormatnya perkara di atas adalah dirujuk.

2. Bersama dengan surat ini dilampirkan surat kelulusan saintifik dan etika bagi projek ini. Segala rekod dan data subjek adalah SULIT dan hanya digunakan untuk tujuan kajian dan semua isu serta prosedur mengenai *data confidentiality* mesti dipatuhi. Kebenaran daripada Pengarah Hospital / Institusi di mana kajian akan dijalankan mesti diperolehi terlebih dahulu sebelum kajian dijalankan. Dato' / Tuan / Puan perlu akur dan mematuhi keputusan tersebut dan undang-undang lain yang berkaitan, termasuklah Akta Akses Kepada Sumber Biologi dan Perkongsian Faedah 2017.

3. Penyelidik- penyelidik dan lokasi kajian yang terlibat ialah:

   HOSPITAL KUALA LUMPUR
   Dr Nor Fadhlina binti Zakaria (Penyelidik Utama)
   Dr Zulfitri 'Azuan Bin Mat Daud (Penyelidik Utama)

   HOSPITAL SERDANG
   Dr Nor Fadhlina binti Zakaria (Penyelidik Utama)
   Dr Zulfitri 'Azuan Bin Mat Daud (Penyelidik Utama)

4. Adalah dimaklumkan bahawa kelulusan ini adalah sah sehingga **26 - September-2020.** Tuan/Puan perlu menghantar dokumen-dokumen seperti berikut selepas mendapat kelulusan etika. Borang-borang berkaitan boleh dimuat turun daripada laman web Jawatakuasa Etika & Penyelidikan Perubatan (JEPP) (http://www.nih.gov.my/mrec).

   i. ***Continuing Review Form*** selewat-lewatnya dalam tempoh 2 bulan (60 hari) sebelum tamat tempoh kelulusan ini bagi memperbaharui kelulusan etika.
   ii. ***Study Final Report*** pada penghujung kajian.
   iii. Mendapat kelulusan etika sekiranya terdapat pindaan ke atas sebarang dokumen kajian / lokasi kajian / penyelidik. Pihak JEPP mempunyai hak untuk menarik balik kelulusan etika sekiranya terdapat perubahan dokumen kajian yang tidak diisytiharkan.

5. Kajian tersebut hanya melibatkan pengumpulan data melalui:

   i. Temu Bual
   ii. Rekod Perubatan
   iii. Prosedur Rawatan Perubatan Rutin

PARTICIPANT INFORMATION SHEET AND INFORMED CONSENT FORM
(for peritoneal dialysis subjects and interventional studies)

1. **Title of study:** Assessing Malnutrition among Dialysis Patients in Government Hospital using Malnutrition Inflammation Score.

2. **Name of investigator:** i) Nurul Syazlin Binti Anuar

   Name of supervisor: Zulfitri 'Azuan Bin Mat Daud

   Name of institution: Universiti Putra Malaysia

3. **Name of sponsor:** -
4. **Introduction:**

   You are invited to participate in this study. The details of the research are described in this document. Please take your time to read through this information sheet and informed consent form before making any decision. Please ask the researcher if anything is unclear or if you like more information. If you wish to participate, you need to sign this informed consent form.

   Your participation in this study is voluntary. You may also refuse to answer any questions you do not want to answer. If you volunteer to be in this study, you may withdraw from it at any time. If you withdraw, any data collected from you up to your withdrawal will still be used for the study.

   This study has been approved by the Medical Research and Ethics Committee, Ministry of Health Malaysia.

5. **What is the purpose of the study?**

   The purpose of this study is to assess malnutrition among dialysis patients in Hospital Serdang and Hospital Kuala Lumpur and its association with socio-demographic background, medical history, anthropometric data, physical function, biochemical data, and dietary intake. This study is very important because the prevalence of malnutrition among dialysis patients is very high and it is closely related to the low quality of life and increased the mortality rate that may negatively impact the patients, the health care sectors and the economy. About 92 subjects from the hemodialysis and continuous ambulatory peritoneal dialysis clinic in Hospital Serdang and Hospital Kuala Lumpur will

will participate in this study. The whole study will last about 3 months and your participation will be about 40 minutes throughout the face to face interview session.

6. What kind of study procedures will I receive?

You will be required to complete a set questionnaire which includes information regarding socio-demographic background, medical history, anthropometric data, physical function, biochemical data, and dietary intake. Your dietary intake will be assessed through interview.

7. What will happen if I decide to take part?

You will be face to face interviewed, the researcher will fill the data collection form which includes information regarding to your socio-demographic background, medical history, anthropometric data, physical function, biochemical data, and dietary intake. Your malnutrition status will be determined by the MIS.

8. When will I be interviewed?

You will be interviewed as soon as possible after you give informed consent.

9. What are my responsibilities when taking part in this study?

It is important that you answer all of the questions asked by the study staff honestly during the interview session.

10. What kind of treatment will I receive after my participation in the trial?

This study does not involve any treatment or further medical references after your participation in this study.

11. What are the potential risks and side effects of being in this study?

There are no risks and side effects of being in this study.

12. What are the benefits of being in this study?

You will be informed with the malnutrition status based on the data from the MIS. You may be referred to dietitian for more information on malnutrition management.

12. What are my alternatives if I do not participate in this study?

You do not have to participate in this study to get treatment for your disease or condition.

14. Who is funding the research?

There is no sponsor funding for the research and you will not be paid to participate in this study. You will also not be charged to participate in this study.

15. Can the research or my participation be terminated early?

You may withdraw from the study at any time.

16. Will my medical information be kept private?

All your information obtained in this study will be kept and handled in a confidential manner, in accordance with applicable laws and/or regulations. When publishing or presenting the study results, your identity will not be revealed without your expressed consent. Individuals involved in this study and in your medical care, qualified monitors and auditors, the sponsor or its affiliates and governmental or regulatory authorities may inspect and copy your medical records, where appropriate and necessary. Data from the study will be archived but your identity will not be revealed at any time.

17. Who should I call if I have questions?

If you have any questions about the study or if you think you have a study related injury and you want information about treatment, please contact the researcher, Nurul Syazlin Binti Anuar at telephone number 013-9598327. You may also contact to our supervisor, Dr. Zulfitri 'Azuan Bin Mat Daud. If you have any questions about your rights as a participant in this study, please contact: The Secretary, Medical Research & Ethics Committee, and Ministry of Health Malaysia, at telephone number 03-2287 4032.

INFORMED CONSENT FORM

Title of Study: Assessing Malnutrition among Dialysis Patients at Government Hospital using Malnutrition Inflammation Score.

By signing below I confirm the following:

- I have been given oral and written information for the above study and have read and understood the information given.
- I have had sufficient time to consider participation in the study and have had the opportunity to ask questions and all my questions have been answered satisfactorily.
- I understand that my participation is voluntary and I can at any time free withdraw from the study without giving a reason and this will in no way affect my future treatment. I am not taking part in any other research study at this time. I understand the risks and benefits, and I freely give my informed consent to participate under the conditions stated. I understand that I must follow the study doctor's (investigator's) instructions related to my participation in the study.
- I understand that study staff, qualified monitors and auditors, the sponsor or its affiliates, and governmental or regulatory authorities, have direct access to my medical record in order to make sure that the study is conducted correctly and the data are recorded correctly. All personal details will be treated as STRICTLY CONFIDENTIAL
- I will receive a copy of this subject information/informed consent form signed and dated to bring home.
- I agree/disagree* for my family doctor to be informed of my participation in this study. *(*delete which is not applicable)*

Subject:

Signature: I/C number:

Name: Date:

Investigator conducting informed consent:

Signature: I/C number:

Name: Date:

Impartial witness: *(Required if subject is illiterate and contents of participant information sheet is orally communicated to subject)*

Signature: I/C number:

Name: Date:

RISALAH MAKLUMAT PESERTA DAN BORANG PERSETUJUAN DAN KEIZINAN PESERTA

(untuk subjek pesakit dialisis dan penyelidikan intervensi)

1. **Tajuk Penyelidikan**: Diagnosis malnutrisi dalam kalangan pesakit dialisi di Hospital Kerajaan dengan menggunakan Malnutrition Inflammation Score.

2. **Nama Penyelidik:** i) Nurul Syazlin Binti Anuar

   Name Penilai: Zulfitri 'Azuan Bin Mat Daud

   Nama Institusi: Universiti Putra Malaysia

3. **Nama Penaja**: -

4. **Pengenalan:**
   Anda dijemput untuk mengambil bahagian dalam kajian ini. Butiran penyelidikan akan diterangkan dalam dokumen ini. Sila baca dan pertimbangkan maklumat ini dengan teliti sebelum anda membuat keputusan. Sila minta daripada penyelidik jika ada sesuatu yang tidak jelas atau jika anda mahukan maklumat lanjut. Sekiranya anda ingin mengambil bahagian, anda perlu menandatangani borang persetujuan ini.

   Penyertaan anda dalam kajian ini adalah secara sukarela. Anda berhak untuk tidak menjawab sebarang pertanyaan atau persoalan yang anda enggan jawab. Jika anda secara sukarela mengambil bahagian dalam kajian ini, anda boleh menarik diri pada bila-bila masa. Sekiranya anda melakukan sedemikian, sebarang data yang dikumpulkan daripada anda masih akan digunakan untuk kajian ini.

   Penyelidikan ini telah mendapat kelulusan Jawatankuasa Etika dan Penyelidikan Perubatan, Kementerian Kesihatan Malaysia.

5. **Apakah tujuan penyelidikan ini dilakukan?**
   Tujuan penyelidikan ini dilakukan adalah untuk mengetahui kelaziman malnutrisi dan hubungkaitnya dengan latarbelakang sosio-demografi, sejarah perubatan, ukuran anthropometri, fungsi fizikal, data biokimia, dan pengambilan diet yang berkaitan dengan kesihatan dalam kalangan pesakit dialisis di Hospital Serdang dan Hospital Kuala Lumpur. Penyelidikan ini diperlukan kerana kelaziman malnutritis adalah tinggi dalam kalangan pesakit

dan ia berkait rapat dengan kualiti hidup yang rendah dan peningkatan risiko kematian yang mungkin memberikan impak negatif terhadap pesakit, serta memberi implikasi kepada status pusat kesihatan dan ekonomi negara. Sejumlah 92 pesakit dari klinik hemodialisis dan dialisis peritoneal berterusan di Hospital Serdang dan Hospital Kuala Lumpur akan menyertai penyelidikan ini. Penyelidikan ini akan berlangsung selama 3 bulan dan tempoh pembabitan anda dalam sesi temubual ini dianggarkan selama 40 minit.

6. Apakah prosedur penyelidikan yang akan saya terima?

Anda diminta untuk menjawab satu set soalan yang mengandungi maklumat mengenai latarbelakang sosio-demografi, sejarah perubatan, ukuran anthropometri, fungsi fizikal, data biokimia, dan pengambilan diet yang berkaitan dengan kesihatan.

7. Apakah yang terjadi sekiranya saya bersetuju untuk menyertai penyelidikan ini?

Anda akan ditemubual untuk melengkapkan borang pengumpulan data penyelidikan termasuk maklumat mengenai latarbelakang sosio-demografi, sejarah perubatan, ukuran anthropometri, fungsi fizikal, data biokimia, dan pengambilan diet yang berkaitan dengan kesihatan. Status malnutrisi anda akan diukur menggunakan MIS.

8. Bilakah saya akan ditemubual?

Anda akan ditemubual secepat mungkin selepas anda memberikan keputusan berkaitan persetujuan ini.

9. Apakah tanggungjawab saya sewaktu menyertai penyelidikan ini?

Adalah penting untuk menjawab semua soalan yang ditanya oleh penyelidik dengan jujur dan sepenuhnya.

10. Apakah jenis rawatan yang akan saya terima selepas menyertai penyelidikan ini?

Kajian ini tidak melibatkan apa-apa rawatan.

11. Apakah risiko dan kesan-kesan sampingan menyertai penyelidikan ini?

Tiada risiko atau kesan sampingan sekiranya anda menyertai penyelidikan ini.

12. Apakah manfaatnya saya menyertai kajian ini?

Anda akan dimaklumkan tentang status malnutrisi berdasarkan data daripada MIS. Anda juga mungkin dirujuk kepada pegawai dietetik untuk mendapatkan info yang lebih lanjut mengenai pengurusan malnutrisi.

13. Apakah rawatan alternatif lain sekiranya saya tidak menyertai penyelidikan ini?

Anda tidak perlu menyertai kajian ini untuk mendapatkan rawatan bagi penyakit atau masalah kesihatan anda.

14. Siapakah yang membiayai penyelidikan ini?

Tiada pihak yang membiayai penyelidikan ini dan anda tidak akan dibayar untuk terlibat dalam penyelidikan ini. Anda juga tidak perlu membayar untuk terlibat dalam penyelidikan ini.

15. Bolehkah penyelidikan ataupun penyertaan saya ditamatkan lebih awal daripada yang dirancang?

Anda dibenarkan untuk menarik diri daripada penyelidikan ini pada bila-bila masa.

16. Adakah maklumat perubatan saya akan dirahsiakan?

Segala maklumat anda yang diperolehi dalam penyelidikan ini akan disimpan dan dikendalikan secara sulit, bersesuaian dengan peraturan-peraturan dan/ atau undang-undang yang berkenaan. Sekiranya hasil penyelidikan ini diterbitkan atau dibentangkan kepada orang ramai, identiti anda tidak akan didedahkan tanpa kebenaran anda terlebih dahulu. Pihak- pihak tertentu seperti individu yang terlibat dalam penyelidikan dan rawatan perubatan anda, juruaudit dan jurupantau yang terlatih, pihak penaja atau pihak gabungannya, pihak berkuasa kerajaan atau undang-undang, boleh memeriksa dan membuat salinan laporan perubatan anda jika berkenaan dan diperlukan. Segala data yang berkaitan dengan penyelidikan ini akan diarkib, tetapi identiti anda tidak akan didedahkan sama sekali pada bila-bila masa.

17. Siapakah yang perlu saya hubungi sekiranya saya mempunyai sebarang pertanyaan?

Sekiranya anda mempunyai sebarang pertanyaan mengenai penyelidikan ini atau jika anda mengesyaki anda mengalami kecederaan yang terhasil daripada penyelidikan ini dan anda mahukan maklumat berkenaan rawatan, sila hubungi penyelidik, Nurul Syazlin Binti pada sambungan telefon 013-9598327. Anda juga boleh menghubungi pemantau penyelidikan ini iaitu Dr. Zulfitri 'Azuan Bin Mat Daud. Jika anda mempunyai sebarang pertanyaan berkaitan dengan hak-hak anda sebagai peserta dalam penyelidikan ini, sila hubungi: Setiausaha, Jawatankuasa Etika & Penyelidikan Perubatan, Kementerian Kesihatan Malaysia, melalui talian telefon 03-2287 4032.

BORANG PERSETUJUAN/ KEIZINAN PESERTA

Tajuk Penyelidikan: Diagnosis malnutrisi dalam kalangan pesakit dialisi di Hospital Kerajaan dengan menggunakan Malnutrition Inflammation Score.

Dengan menandatangani di bawah, saya mengesahkan bahawa:

- Saya telah diberi maklumat tentang penyelidikan di atas secara lisan dan bertulis and saya telah membaca dan memahami segala maklumat yang diberikan dalam risalah ini.
- Saya telah diberikan masa yang secukupnya untuk mempertimbangkan penyertaan saya dalam penyelidikan ini dan telah diberi peluang untuk bertanyakan soalan dan semua persoalan saya telah dijawab dengan sempurna dan memuaskan.
- Saya juga faham bahawa penyertaan saya adalah secara sukarela dan pada bila-bila masa saya bebas menarik diri daripada penyelidikan ini tanpa harus memberi sebarang alasan dan ianya sama sekali tidak akan menjejaskan rawatan perubatan saya pada masa akan datang. Saya tidak mengambil bahagian dalam mana-mana penyelidikan lain pada masa ini. Saya juga memahami tentang risiko dan manfaat penyelidikan ini dan saya secara sukarela memberi persetujuan untuk menyertai penyelidikan ini di bawah syarat-syarat yang telah dinyatakan di atas. Saya faham saya harus mematuhi nasihat dan arahan yang berkaitan dengan penyertaan saya dalam penyelidikan ini daripada doktor penyelidikan (penyelidik).
- Saya faham bahawa kakitangan penyelidikan, pemantau dan juruaudit terlatih, pihak penaja atau gabungannya, dan pihak berkuasa kerajaan atau undang-undang, mempunyai akses langsung dan boleh menyemak laporan perubatan saya bagi memastikan penyelidikan ini dijalankan dengan betul dan data direkodkan dengan betul. Segala maklumat dan data peribadi akan dianggap sebagai SULIT.
- Saya akan menerima satu salinan 'Risalah Maklumat Peserta dan Borang Persetujuan atau Keizinan Peserta' yang telah lengkap dengan tarikh dan tandatangan untuk dibawa pulang ke rumah.
- Saya bersetuju/ tidak bersetuju* untuk doktor yang merawat keluarga saya diberitahu tentang penyertaan saya dalam penyelidikan ini. *(*Potong mana yang tidak berkenaan)*

Subjek:

Tandatangan: No. Kad Pengenalan:

Nama: Tarikh:

Penyelidik yang mengendalikan proses menandatangani borang keizinan:

Tandatangan: No. Kad Pengenalan:

Nama: Tarikh:

<u>Saksi tidak-berpihak/adil:</u> *(Diperlukan; jika subjek adalah buta huruf dan kandungan risalah maklumat peserta disampaikan secara lisan kepada subjek)*

Tandatangan: No. Kad Pengenalan:

Nama: Tarikh:

FACULTY OF MEDICINE AND HEALTH SCIENCES DEPARTMENT OF NUTRITION AND DIETETICS

Questionnaire Form

"Confidential"

Research Title:

Assessing Malnutrition among Dialysis Patients in Government Hospital using Malnutrition Inflammation Score

Name : Nurul Syazlin Binti Anuar (195369)

Course : Bachelor Science Dietetics

Supervisor : Dr. Zulfitri 'Azuan Mat Daud

Date of Collection :

This study is conducted for academic purpose only. All information will be kept private and confidential. This questionnaire consists of five section namely socio-demographic, medical history, anthropometry measurement, biochemical data, clinical data and dietary intake. All the details instructions are given according to the section. Thank you for your cooperation in answering this questionnaire.

NMRR-19-2501-50205	Subject code:

Questionnaire (Please tick or fill in the blanks as appropriate)

A. Sociodemographic characteristics

1. Gender: ☐ Male ☐ Female 2. Date of birth:|__|__| |__|__| |__|__| 3. Age:|__|__| years old
DD MM YY

4. Telephone no (Mobile):_____ 5. Time to talk:_____am/pm

6. Ethnicity: ☐ Malay ☐ Chinese ☐ Indian ☐ Other, please specify _____

7. Marital status: ☐ Single ☐ Married ☐ Other, please specify _____

8. Current living status: ☐ Alone ☐ Own family ☐ Parent ☐ Others, please specify _____

9. Education background: ☐ No formal education ☐ Primary ☐ Secondary ☐ College/University

10. Employment status: ☐ Employed ☐ Unemployed

11. Household income: ☐ <RM 500 ☐ RM 2001- RM 3000 ☐ >RM 5000
☐ RM 501 - RM 1000 ☐ RM 3001 - RM 4000
☐ RM 1001- RM 2000 ☐ RM 4001 – RM 5000

12. Have you been referred to a dietitian before? ☐ Yes ☐ No

B. Medical history

1. Date diagnosed with end-stage renal failure _____ (date/year).

2. Primary cause(s) of end-stage renal failure:

Unknown	☐	Nephrophytisis	☐
Diabetes Mellitus	☐	Adult polycystic kidney damage (APKD)	☐
Hypertension	☐	Gout nephropathy	☐
SLE	☐	Toxic nephropathy	☐
Kidney stone	☐	HIV nephropathy	☐
Glomerulonephritis	☐	Others:	☐

3. Dialysis modality: ☐ Hemodialysis ☐ Peritoneal dialysis

NMRR-19-2501-50205	Subject code:

4. Year started hemodialysis/peritoneal dialysis: _____(year)

5. Duration on dialysis: _____(months)

6. Major co-morbidities

Diabetes Mellitus		Cardiovascular disease (CVD)	
Hypertension		Gastropathy	
Hyperlipidemia		Haemorrhoids	
Hepatitis B		Anaemia	
Hepatitis C		Secondary hyperparathyroidism	
HIV		Cancer	
Liver failure		Others:	

7. Dentures: ☐ Yes ☐ No

8. Information regarding peritoneal dialysate (*only applicable for peritoneal dialysis patients*)

Beg No	**Time**	**Concentration of dialysate solution (%)**	**Volume of dialysate In (ml)**	**Volume of dialysate Out (ml)**	**Duration (min)**	**Amount of dialysate absorbed (ml)**	**UF%**

NMRR-19-2501-50205	Subject code:

C. Anthropometry assessment

Height: _____(m)

Current post-dialysis weight: _____(kg)

Body Mass Index: _____(kg/m^2)

Current dry-weight: _____(kg)

Dry-weight (3 months ago): _____(kg)

Dry-weight (6 months ago): _____(kg)

	Reading 1	**Reading 2**	**Reading 3**	**Mean**
Length from acromiale to radiale (cm)				
Midpoint between acromiale and radiale (cm)				
Mid-arm circumference (cm)				
Triceps skinfold (mm)				

Mid-arm muscle circumference, MAMC[MAC (cm) – (π x TSF (cm)] = _____(cm)

Mid-arm muscle area, MAMA = _____(cm^2)

Formula

MAMA (for male) = $[(\text{MAC (cm)} - \pi \times \text{TSF (cm)})^2/4\pi] - 10$

MAMA (for female) = $[\text{MAC (cm)} - \pi \times \text{TSF (cm)})^2/4\pi] - 6.5$

Physical function

(Measured on non-fistula hand/ dominant hand)

	Reading 1	**Reading 2**	**Reading 3**	**Median**
Handgrip strength (kg)				

Physical Examination

Decreased fat stores or loss of subcutaneous fat (below eye, triceps, biceps, chest)			
0 normal (no change)	1 mild	2 moderate	3 severe
Signs of muscle wasting (temple, clavicle, scapula, ribs, quadriceps, knee, interosseous)			
0 normal (no change)	1 mild	2 moderate	3 severe

NMRR-19-2501-50205	Subject code:

E. Biochemical data

Parameters	Blood test results Current (Date)_____	Normal range
Renal profile		
Serum urea (mmol/L)		
Creatinine (mmol/L)		
Serum phosphate (mmol/L)		
Liver function		
Serum albumin (g/L)		
Hematology		
Hemoglobin (g/L)		
Lipid profile		
Serum cholesterol (mmol/L)		

NMRR-19-2501-50205	Subject code:

F. Clinical data

Average blood pressure/week:_____(mm/Hg)

Malnutrition Inflammation Score

COMPREHENSIVE MALNUTRITION INFLAMMATION SCORE			
(A) Patients' related medical history:			
1- Change in end dialysis dry weight (overall change in past 3-6 months):			
0	1	2	3
No decrease in dry weight or weight loss <0.5 kg	Minor weight loss (>0.5 kg but <1 kg)	Weight loss more than one kg but <5%	Weight loss >5%
2- Dietary intake:			
0	1	2	3
Good appetite and no deterioration of the dietary intake pattern	Somewhat sub-optimal solid diet intake	Moderate overall decrease to full liquid diet	Hypo-caloric liquid to starvation
3- Gastrointestinal (GI) symptoms:			
0	1	2	3
No symptoms with good appetite	Mild symptoms, poor appetite or nauseated occasionally	Occasional vomiting or moderate GI symptoms	Frequent diarrhea or vomiting or severe anorexia
4- Functional capacity (nutritionally related functional impairment):			
0	1	2	3
Normal to improved functional capacity, feeling fine	Occasional difficulty with baseline ambulation, or feeling tired frequently	Difficulty with otherwise independent activities (e.g. going to bathroom)	Bed/chair-ridden, or little to no physical activity
5- Co-morbidity including number of years on Dialysis:			
0	1	2	3
On dialysis less than one year and healthy otherwise	Dialyzed for 1-4 years, or mild co-morbidity (excluding MCC*)	Dialyzed >4 years, or moderate co-morbidity (including one MCC*)	Any severe, multiple co-morbidity (2 or more MCC*)
(B) Physical Exam (according to SGA criteria):			
6- Decreased fat stores or loss of subcutaneous fat (below eyes, triceps, biceps, chest):			
0	1	2	3
Normal (no change)	mild	moderate	Severe
7- Signs of muscle wasting (temple, clavicle, scapula, ribs, quadriceps, knee, interosseous):			
0	1	2	3
Normal (no change)	mild	moderate	Severe
(C) Body mass index:			
8- Body mass index: BMI = Wt(kg) / Ht^2(m)			
0	1	2	3
BMI>20 kg/m^2	BMI: 18-19.99 kg/m^2	BMI: 16-17.99 kg/m^2	BMI<16 kg/m^2
(D) Laboratory Parameters:			
9- Serum albumin:			
0	1	2	3
Albumin> 4.0 g/dL	Albumin: 3.5-3.9 g/dL	Albumin: 3.0-3.4 g/dL	Albumin: <3.0 g/dL
10- Serum TIBC (total Iron Binding Capacity): ♣			
0	1	2	3
TIBC> 250 mg/dL	TIBC: 200-249 mg/dL	TIBC: 150-199 mg/dL	TIBC: <150 mg/dL
Total Score = sum of above 10 components (0-30):			

*MCC (Major Comorbid Conditions) include CHF class III or IV, full blown AIDS, severe CAD, moderate to severe COPD, major neurological sequlae, and metastatic malignancies or s/p recent chemotherapy.

♣ Suggested equivalent increments for serum transferrin are: >200 (0), 170-199 (1), 140-169 (2), and <140 mg/dl

NMRR-19-2501-50205	Subject code:

3-day diet records

Diet recall Day 3 (date): _____

HD patient: ☐ Dialysis day ☐ Non-dialysis day ☐ Weekend

PD patient: ☐ Weekday ☐ Weekday ☐ Weekend

Place eaten/Time	Description of food and drink	Portion size	Preparation method

NMRR-19-2501-50205	Subject code:

3-day diet records

Diet recall Day 2 (date): _____

HD patient: ☐ Dialysis day ☐ Non-dialysis day ☐ Weekend

PD patient: ☐ Weekday ☐ Weekday ☐ Weekend

Place eaten/Time	Description of food and drink	Portion size	Preparation method

NMRR-19-2501-50205	Subject code:

3-day diet records

Diet recall Day 1 (date): _____

HD patient: ☐ Dialysis day ☐ Non-dialysis day ☐ Weekend

PD patient: ☐ Weekday ☐ Weekday ☐ Weekend

Place eaten/Time	Description of food and drink	Portion size	Preparation method