UNIVERSITI PUTRA MALAYSIA

FACTORS ASSOCIATED WITH ADHERENCE TO LOW PROTEIN DIET AMONG PATIENTS WITH NON-DIALYSED CHRONIC KIDNEY DISEASE AT A SPECIALIST HOSPITAL IN JOHOR, MALAYSIA

LEONG SIM KIAN

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By

LEONG SIM KIAN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

November 2019

DEDICATION

This dissertation is dedicated to the significant people in my life:

Leong Ting Juan, Ng Sheok Wuan

My beloved late father who always supported me emotionally and financially till his last day for my pursue in my postgraduate study. My mother who never failed to provide me moral support – enabled me to dedicate hours of work, contemplation, and writing necessary to complete this research

Dr. Zulfitri 'Azuan Mat Daud

My dearest supervisor who always inspire me to be better in both clinical and research dietitian. Who never pressurized me negatively in completing my work and supported me in many conferences and training for the betterment of my knowledge.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

FACTORS ASSOCIATED WITH ADHERENCE TO LOW PROTEIN DIET AMONG PATIENTS WITH NON-DIALYSED CHRONIC KIDNEY DISEASE AT A SPECIALIST HOSPITAL IN JOHOR, MALAYSIA

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November 2019

Chairman : Zulfitri 'Azuan Mat Daud, PhD
Faculty : Medicine and Health Sciences

Chronic kidney disease (CKD) has emerged as one of the significant public health issues worldwide. Locally, one in eleven Malaysian adults is diagnosed with CKD. Management of CKD has been primarily focused on delaying the progression to end-stage kidney disease (ESKD). Although the benefits of low protein diet (LPD) on retarding CKD progression is well reported, patients' adherence remains the main challenge in LPD implementation. In fact, in the local context, literature is scarce on dietary non-adherence, particularly in LPD and its associated factors, thus hamper strategic planning for intervention. Therefore, this present study was undertaken to evaluate the adherence of LPD among CKD patients and investigating a variety of factors that may affect the adherence including socio-demographic factors, medical history, anthropometry measurements, body composition, biochemical markers, dietary knowledge, appetite level, clinical factors, and psychological factors including stress and health locus of control.

This study was a cross-sectional study conducted in Hospital Pakar Sultanah Fatimah Muar, Malaysia, on stage 3 to 5 CKD patients. Purposeful sampling was done on patients fulfilling the study criteria. Social and medical history was obtained through an interview using a questionnaire. Anthropometry measurements were done following the International Society for the Advancement of Kinanthropometry (ISAK), and body composition was measured with a body composition analyzer. Dietary intake was evaluated with three days of dietary records. Dietary energy intake (DEI) and dietary protein intake (DPI) were compared with Kidney Disease Outcomes Quality Initiative (KDOQI) recommendations with an LPD adherence rate set at ±20% of recommended intake. Dietary appetite was assessed using the appetite and diet assessment tool (ADAT). Dietary knowledge was assessed using a modified dietary knowledge questionnaire. Perceived stress scale and multidimensional health

locus of control were measured with validated questionnaires at the ESKD population. Binary logistic regression analysis was performed between adherent status with investigated variables to determine predicting variables.

A total of 113 patients (54% male) with a mean age of 56.3±12.8 years old (age range 22 to 83 years) and mean estimated glomerular filtration rate (eGFR) of 17.5±11.2 mL/min per 1.73m^2 were included in the final analysis. Overall, mean DEI and DPI were 22.4±5.9 kcal/kg/day and 0.83±0.28 g/kg/day, respectively. Only 34.5% of patients adhere to the LPD diet, with 59% exceeding the DPI recommendation. Patients were categorized into three groups according to mean protein intake. Patients with DPI <20%, ±20%, and >20% of the recommended value were classified as NADL, AD, and NADH, respectively. A variety of factors significantly associated with LPD adherence including the stage of CKD, higher serum urea level, lower total white blood cell count, better fasting blood glucose, better blood pressure profile, and reduced dietary energy intake. Multivariate logistic regression model shows that CKD patients were 30% less likely to adhere to LPD with each additional day of hospitalization (OR 0.707, 95%CI 0.50-1.00, p=0.048). Patients with higher DEI were 26% less likely to adhere to LPD (OR 0.744, 95%CI 0.65-0.85, p<0.001). CKD stage 4 patients are approximately 70% less likely to adhere to LPD as compared to stage 5 CKD patients (OR 0.318, 95%CI 0.13-0.77, p=0.012). CKD patients having good dietary knowledge scores were 62% less likely to adhere to LPD as compared to patients with poor dietary knowledge (OR 0.380, 95%CI 0.17-0.85, p=0.018).

This study shows that LPD adherence among CKD patients is at an alarmingly low rate of 34.5%. Four predicting factors found to be associated with poorer LPD adherence were lower DEI, shorter duration of hospitalization, further progression of CKD, and poorer dietary knowledge scores. Predicting variables from our study suggest that exposure and education of LPD should be started at earlier stages of CKD instead of conservative management for ESKD patients refusing dialysis. Medical nutrition therapy by dietitians should not mainly focus on increasing knowledge alone as it is not predictive of adherence, and higher knowledge may affect adherence negatively. Findings from our study suggest that behavioral changes in an individual are multi-factorial and warrants for future interventional studies with the inclusion of more psychosocial parameters in improving LPD adherence.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains

FAKTOR-FAKTOR BERKAITAN DENGAN PEMATUHAN DIET RENDAH PROTEIN DALAM KALANGAN PESAKIT BUAH PINGGANG KRONIK BUKAN DIALISIS DI SEBUAH HOSPITAL PAKAR JOHOR, MALAYSIA

Oleh

LEONG SIM KIAN

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Penyakit buah pinggang kronik (PBPK) merupakan salah satu isu kesihatan awam yang semakin membimbangkan di peringkat dunia. Di Malaysia, dianggarkan satu daripada sebelas orang dewasa sedang menghidap PBPK. Sebahagian besar pengurusan PBPK adalah tertumpu kepada melewatkan kegagalan buah pinggang sepenuhnya. Terdapat pelbagai laporan telah menyatakan manfaat diet rendah protein (DRP) dalam melengahkan perkembangan PBPK. Namun, pematuhan pesakit masih merupakan satu cabaran utama dalam pelaksanaan DRP. Malah, dalam konteks tempatan, terdapat kekurangan kajian yang berkaitan dengan ketidakpatuhan makanan khususnya dalam DRP dan faktor-faktor yang berkaitan, sehingga merencatkan perancangan strategik untuk penambahbaikan. Oleh itu, kajian ini dijalankan untuk menilai pematuhan DRP dalam kalangan pesakit PBPK dan menyiasat pelbagai faktor yang boleh mempengaruhi pematuhan tersebut termasuk sosio-demografi, masalah perubatan, pengukuran antropometri, komposisi badan, penanda biokimia, pengetahuan pemakanan, tahap selera makanan, keadaan klinikal, serta faktor psikologi termasuk stres dan lokus kawalan kesihatan.

Kajian ini merupakan satu kajian hirisan lintang yang dijalankan di Hospital Pakar Sultanah Fatimah, Muar, Malaysia dalam kalangan PBPK yang berada di antara peringkat tiga hingga lima. Pengambilan makanan dinilai dengan rekod pemakanan sepanjang tiga hari. Pengambilan tenaga dan protein dalam diet telah dibandingkan dengan saranan daripada *Kidney Disease Outcomes Quality Initiative (KDOQI)* dan pematuhan DRP ditetapkan di antara ±20% daripada pengambilan protein yang disarankan. Faktor-faktor yang diselidik adalah diukur dan dinilai mengikut teknik piawai yang sah dan sedia ada. Komposisi badan pesakit diukur dengan mesin komposisi badan. Analisis

regresi logistik binari dilakukan untuk menentukan faktor-faktor yang berkaitan dengan pematuhan DRP.

Sejumlah 113 pesakit (54% lelaki) dengan purata umur 56.3±12.8 tahun (22 hingga 83 tahun) dan purata anggaran kadar penapisan glomerular sebanyak 17.5±11.2 mL/min setiap 1.73m^2 telah dimasukkan dalam analisis terakhir. Secara keseluruhannya, pengambilan tenaga dalam diet adalah 22.4±5.9 kcal/kg/hari dan pengambilan protein dalam diet adalah 0.83±0.28 g/kg/hari. Hanya 34.5% daripada pesakit mematuhi yang DRP dengan 59% melebihi saranan DRP. Dalam analisis, pesakit dibahagikan kepada tiga kumpulan mengikut pematuhan DRP. Terdapat pelbagai faktor yang berkait dengan pematuhan DRP, termasuk peringkat PBPK, kandungan urea dalam darah yang lebih tinggi, jumlah sel darah putih yang lebih rendah, glukosa darah berpuasa yang lebih baik, profil tekanan darah yang lebih baik, dan pengambilan tenaga diet yang berkurangan. Model regresi logistik menunjukkan bahawa pesakit PBPK adalah 30% kurang berkemungkinan untuk mematuhi DRP dengan setiap penambahan hari penginapan di hospital (OR 0.707, 95% CI 0.50-1.00, p=0.048). Pesakit yang mempunyai pengambilan tenaga dalam diet yang lebih tinggi adalah 26% kurang berkemungkinan untuk mengikuti DRP (OR 0.744, 95% CI 0.65-0.85, p<0.001). Pesakit tahap empat adalah 70% kurang cenderung untuk mematuhi DRP berbanding dengan pensakit yang berada di tahap lima PBPK (OR 0.318, 95% CI 0.13-0.77, p=0.012). Pesakit PBPK yang mempunyai skor pengetahuan diet yang baik adalah 62% kurang berkemampuan untuk mematuhi DRP berbanding dengan pesakit dengan pengetahuan diet yang lagi lemah (OR 0.380, 95% CI 0.17-0.85, p=0.018).

Kajian ini menunjukkan bahawa pengambilan tenaga dalam diet dalam kalangan pesakit PBPK adalah tidak mencukupi manakala pengambilan protein dalam diet adalah tinggi dengan pematuhan DRP pada kadar yang rendah. Kajian ini menunjukkan bahawa perubahan tingkah laku dalam seorang individu adalah berkaitan dengan pelbagai faktor. Justeru, adalah disarankan penambahan lebih banyak parameter kajian dalam penyiasatan faktor yang berkaitan dengan amalan pemakanan, terutamanya DRP pada kajian di masa hadapan.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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Universiti Putra Malaysia

Date: 10 September 2020

Declaration by graduate student

I hereby confirm that:

- this thesis is my original work;
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- this thesis has not been submitted previously or concurrently for any other degree at any other institutions;
- intellectual-property from the thesis and copyright of thesis are fully-owned by Universiti Putra Malaysia, as according to the Universiti Putra Malaysia (Research) Rules 2012;
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Signature: _____ Date: _____

Name and Matric No.: Leong Sim Kian (GS45644)

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LIST OF ABBREVIATIONS

AAMI	Advancement of medical instrumentation
ADAT	Appetite and Diet Assessment Tool
AD	Low protein diet adherer
Alb	Albumin
BCM	Body composition machine
BMI	Body mass index
BMR	Basal metabolic rate
BSA	Body surface area
BW	Bodyweight
CKD	Chronic kidney disease
CVD	Cardiovascular disease
Da	Dalton
DBP	Diastolic blood pressure
DEI	Dietary energy intake
DM	Diabetes mellitus
DPI	Dietary protein intake
DRP	Diet rendah protein
ECW	Extracellular water
EGFR	Estimated glomerular filtration rate
ESKD	End-stage kidney disease
FFQ	Food frequency questionnaire
FGF-23	Fibroblast growth factor 23
FM	Fat mass
GI	Gastrointestinal

Hb	Hemoglobin
HBV	High biological value
HD	Hemodialysis
HDL-C	High-density lipoprotein cholesterol
HGS	Handgrip strength
HIV	Human immunodeficiency virus
HPD	High protein diet
HPSF	Hospital sultanah pakar fatimah
HPT	Hypertension
IBW	Ideal body weight
ICW	Intracellular water
KDIGO	Kidney disease: improving global outcomes
KDOQI	Kidney disease outcomes quality initiative
LDL-C	Low-density lipoprotein cholesterol
LPD	Low protein diet
LTM	Lean tissue mass
MAMA	Mid arm muscle area
MAMC	Mid arm muscle circumference
MAP	Mean arterial pressure
MDRD	Modification of Diet in Renal Disease Study
MHLC	Multidimensional Health Locus of Control
NADH	Non-Adherer to Low Protein Diet (Protein Intake Higher Than Recommendation)
NADL	Non-Adherer to Low Protein Diet (Protein Intake Lower Than Recommendation)
NDCKD	Non-dialyzed chronic kidney disease

NICE	National Institute for health and care excellence
OR	Odds ratio
PBPK	Penyakit buah pinggang kronik
PEW	Protein-energy wasting
PMP	Per million population
PSS	Perceived stress scale
PTH	Parathyroid hormones
RASS	Renin-angiotensin system
RCT	Randomized control trial
REE	Resting energy expenditure
RM	Ringgit Malaysia
ROS	Reactive oxygen species
RRT	Renal replacement therapy
RTEM	Relative Technical Error of Measurement
SBP	Systolic blood pressure
TBW	Total body water
TEE	Total energy expenditure
TEM	Technical Error of Measurement
TSF	Triceps skinfold
TWBC	Total white blood cell count
VLPD	Very low protein diet
WC	Waist circumference

CHAPTER 1

INTRODUCTION

1.1 Background of the study

Chronic kidney disease (CKD), with its increasing prevalence, has emerged as one of the significant public health issues worldwide (Jager & Fraser, 2017). CKD patients experience an alarmingly high rate of cardiovascular complications where cardiovascular disease (CVD) is the leading cause of morbidity and mortality. CKD patients are 15 to 30 times more likely to have CVD events than the age-matched general population (Collins, 2003; Go, Chertow, Fan, McCulloch, & Hsu, 2004; Sarnak & Levey, 2000; Schiffrin, Lipman, & Mann, 2007). Worsening kidney function is a predictor of hospitalization (Gansevoort et al., 2013; Go et al., 2004), cognitive dysfunction (Etgen, Chonchol, Frstl, & Sander, 2012) and reduced quality of life (Chin et al., 2008; Perlman et al., 2005). Furthermore, around 35% of CKD patients are over 70 years of age, further increases the healthcare burden (O'Callaghan, Shine, & Lasserson, 2011).

In Malaysia, a similar prevalence is seen where roughly one in every eleven adults has CKD, but alarmingly only 4% of these patients were aware of their condition (Hooi et al., 2013). This increasing prevalence of CKD is reflected by the linearly increasing numbers of new dialysis patients and the dialysis acceptance rate over the past ten years. The national dialysis prevalence rate has increased almost two folds from 626 per million population (pmp) in 2007 to at least 1286 pmp in 2016. On the other hand, the new transplant recipient rate showed no changes at three to four pmp over the same period (Wong & Goh, 2018).

CKD can be defined by an estimated glomerular filtration rate (eGFR) less than 60 ml/min/1.73m^2 that is present for more than three months with or without evidence of kidney damage or evidence of kidney damage that is present more than three months with or without eGFR <60 ml/min/1.73m^2. Markers of kidney damage include albuminuria, abnormalities of urine sediments, or electrolyte caused by tubular damages, structural abnormalities detected by imaging, or history of kidney transplantation (KDIGO, 2013). Currently, both Kidney Outcomes Quality Initiative (2001) and National Institute for Health Excellence (2008) recommended the usage of serum creatinine concentration to estimate GFR using the equation developed by Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) (Levey et al., 2009). Five stages can be used to classify CKD using thresholds of eGFR or evidence of structural kidney changes, e.g., proteinuria (Joel D. Kopple, 2001). Furthermore, it was suggested that stage 3

to be subdivided into 3a and 3b for better reflection of CVD risk (NICE, 2008). The classification of CKD based on GFR categories is shown in Table 1.1.

Table 1.1: Current CKD staging based on GFR

GFR Category	GFR (ml/min/1.73m^2)	Term
G1	≥ 90	Normal
G2	60 – 89	Mildly decreased*
G3a	45 – 59	Mildly to moderate
G3b	30 – 44	Moderately to severe
G4	15 – 29	Severely decreased
G5	< 15	Kidney failure

(Source: KDIGO, 2013)

Note: GFR, glomerular filtration rate, CKD, chronic kidney disease;

*In the absence of evident kidney damage, neither GFR category G1 nor G2 fulfills the criteria of CKD

Management of CKD has been primarily focused on delaying the progression to ESKD, which in time, patients will be expected to rely on renal replacement therapy (RRT), mostly in the form of maintenance dialysis treatment such as hemodialysis (HD) or peritoneal dialysis (PD) (Saggi et al., 2012).

Restricting dietary protein intake (DPI) remained as the core for the nutritional therapy for CKD ever since reports from the 1900s demonstrated that hyper-azotemia suffered by advance CKD patients was due to the retention of uremic toxins from the ingestion of dietary proteins (Borst, 1948; Lewis, 1921; Mackay, Addis, & Mackay, 1938). The benefits of protein restrictions had led to the standardized prescription of LPD as a treatment for uremia for advanced CKD patients in the 1960s (Giovannetti & Maggiore, 1964).

After that, with the medical advancements of dialysis and kidney transplantation, LPD was prescribed as a means to delay CKD progression by protecting residual kidney functions as lower protein intake reduces glomerular hypertrophy and hyper-filtration (Epstein, Brenner, Meyer, & Hostetter, 1982).

However, these earlier LPD prescriptions were rigid and complex to follow. For example, a typical dinner published by Giovannetti and colleagues in 1970 was as such: “50 g egg; 15 g lettuce; 55 g tomato; 30 g cooked beetroot; 50 g low-protein bread; 15 g unsalted butter; 100 g canned mandarins (80 g fruit + 20 g juice) and 15 g single cream” (P. L. Wright, Brereton, & Snell, 1970). It is noteworthy that earlier authors reported different levels of protein restriction, initially defining LPD according to total protein content such as the 40g or the 18 to 20g diets (Giovannetti & Maggiore, 1964; P. L. Wright et al., 1970) and later according to patients weight until the publication of KDOQI guidelines which standardized LPD according to a range of 0.3 to 0.75 gram of protein per kilogram of patients body weight per day (g/kg/day) (Joel D. Kopple, 2001)

1.2 Problem Statement

Despite being researched for more than 30 years, the effectiveness of LPD in ESKD prevention remained inconclusive until the 2000s. This inconclusiveness is mainly due to the findings from a large randomized clinical trial of 1585 CKD patients from the Modification of Diet in Renal Disease (MDRD) study, which reported no beneficial effects regarding the efficacy of LPD in delaying the progression of CKD (Klahr et al., 1994).

The MDRD study was conducted to test the hypothesis that a reduction in DPI was able to effectively and safely delay the progression of CKD. The authors randomly assigned 1585 CKD stage 3 and 4 patients to LPD (0.58 g/kg/day) or a usual protein diet (1.3 g/kg/day) and evaluated the patients monthly up to 45 months. The primary outcome of the study was the change in GFR rate over time (Klahr et al., 1994). This study remains to date the largest RCT to test the hypothesis.

Additionally, the improvements of the dialysis industry and recommendations to initiate dialysis earlier have led to reduced interest in LPD in CKD management for the past 20 years, worldwide (Bellizzi et al., 2016; Kalantar-Zadeh et al., 2016; Mafra & Leal, 2016). A recent integrative review on 60 dietary adherence studies consisting of 24,743 adult patients with stage 4 or 5 CKD, either conservatively managed or on any renal replacement therapy modality demonstrated that majority of the papers focused on ESKD patients undertaking HD (72%) with only five papers (8%) reported on non-dialyzed CKD (NDCKD) populations (Lambert, Mullan, & Mansfield, 2017).

Furthermore, the implementation of LPD has also raised concerns about its potentially harmful effects on the clinical outcome and nutritional status of CKD patients. It is well noted that CKD patients are often present with PEW; which is a state of nutritional and metabolic derangements characterized by the simultaneous loss of energy stores and systematic body protein and, leading ultimately to a severe loss of muscle and fat mass (D. Fouque et al., 2008). CKD patients with PEW, particularly those with CKD stage 3b, 4, and 5, as well as ESKD patients on maintenance dialysis treatment, are closely associated with mortality and morbidity (Obi, Qader, Kovesdy, & Kalantar-Zadeh, 2015).

Causes of PEW include hypercatabolic status, uremic toxins, malnutrition, and inflammation (Carrero et al., 2013). Unintentional low DPI (<0.80 g/kg/day for at least two months for dialysis patients or <0.6 g/kg/day for patients with CKD stages 2 to 5), as well as unintentional low dietary energy intake (DEI) (<25 kcal/kg/day for at least two months), are among the readily utilizable criteria for the clinical diagnosis of PEW in CKD (D. Fouque et al., 2008). The conceptual model for CKD progression, PEW, and its consequences are shown in Figure 1.1.

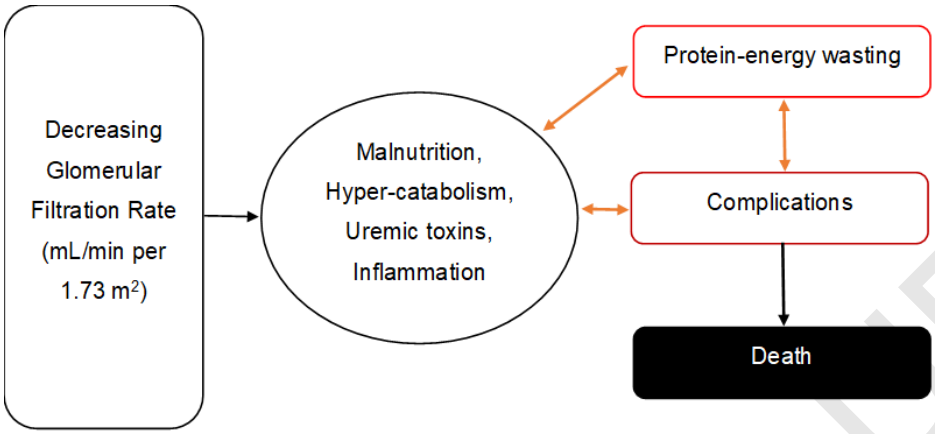

Figure 1.1: The conceptual model for CKD progression, PEW, and its consequences.
(Source: Obi et al., 2015)

However, newer findings have suggested that earlier initiation of dialysis therapy may not be appropriate (Cooper et al., 2010; Kurella Tamura et al., 2009). Earlier dialysis initiation was associated with a significant and sustained decline in functional status among elderly nursing home patients (Kurella Tamura et al., 2009). It is well reported that before dialysis consideration, the majority of CKD patients prefer to exhaust all available conservative managements, including nutritional strategies (Bolasco, Kalantar-Zadeh, & Rhee, 2017).

Furthermore, secondary analyses of the MDRD study undertaken later concluded that there were beneficial effects of restricting protein intake (Levey et al., 1999). This conclusion was further strengthened by several meta-analyses later that focused on the progression rate of CKD, which showed favorable but modest effects of LPD (Denis Fouque & Laville, 2009; Kasiske, Lakatua, Ma, & Louis, 1998).

In terms of safety, multiple RCTs were able to prove that with adequate calorie intake and frequent dietitian monitoring, patients with LPD or VLPD were able to maintain satisfactory nutritional status with little adverse effects on the clinical outcome (Denis Fouque & Aparicio, 2007; Thilly, 2013). These newer findings have led nephrologists to revisit the use of LPD as therapy management for CKD patients (Bellizzi et al., 2016; Kalantar-Zadeh et al., 2016; Mafra & Leal, 2016)

However, patients' adherence remains the main challenge in LPD implementation. Adherence is vital to attain the reported benefits of LPD in CKD management. Multiple adherence predicting factors were analyzed and reported, however, with considerable variability among the studies preventing a conclusive finding. Psychosocial factors such as knowledge, attitude, and support are amongst the main factors that influence LPD adherence (Bellizzi, 2013).

Although patients are enrolled in a controlled environment of close dietary consultation, monitoring, and measures of motivation, the adherence rate was highly variable even in RCTs (Denis Fouque et al., 2016). A meta-analysis of RCTs studying on LPD found that the mean DPI in the intervention group was 0.68 g/kg/day as compared to the control group at 0.92 g/kg/day, which was higher than the targeted value but lower than the recommendation for the general population (Piccoli et al., 2016).

Furthermore, it is noteworthy that two main factors suggested for the failure of the MDRD study to demonstrate beneficial results were a short follow up duration (2.2 years on average) and the poor compliance of patients with LPD with estimated dietary protein intake (DPI) of 0.73 – 0.77 g/kg/day instead of the prescribed 0.6 g/kg/day (Thilly, 2013). The high prevalence of reduced adherence rates has led to the debate on the clinical applicability of LPD.

Currently, the challenge remains on improving adherence to LPD implementation (Thilly, 2013). Thus, there is the utmost importance to investigate possible risk factors for non-adherence to improve the feasibility and patients' satisfaction.

1.3 Justification of the study

Today, there are no reports or data on the practices of LPD (0.6-0.8 g/kg/day) as a means of managing CKD progression in Malaysia. With the alarming rate of ESKD in the country, there is an urgency to revisit the implementation of LPD for CKD patients. Consequently, with the high prevalence of reduced LPD adherence rates reported, factors associated with this adherence should be explored to help patients to adhere to their LPD. The investigation into patients' access to medical or dietetic care, nutritional status, and psychosocial factors such as knowledge, attitude, and perceived stress level may provide initiatives to improve the attractiveness of LPD. Thus, encouraging adherence and satisfaction towards LPD.

Considering the research gap on dietary knowledge, psychosocial factors, and dietary adherence in CKD patients, this study aims to identify the dietary knowledge and practice, perceived stress level, and locus of control and their relationships with LPD compliance in CKD patients. All these factors are modifiable, whereby positive changes will result in clinical benefits for CKD patients.

Findings from this study intend to propose a model reflecting the determinants of poor LPD compliance in a multi-ethnic Malaysian CKD population. As such, this proposed model can be used as a reference to identify poor LPD compliant CKD patients in other local institutions. The identification of the factors

associated with LPD compliance provides a substantial impact on clinical decision making and future treatment policies to improve LPD compliance among CKD patients. Such data is deemed necessary given the significant association between poor dietary compliance with poorer health outcomes, particularly mortality among CKD and ESKD patients (Desroches et al., 2013; Saran et al., 2003).

Therefore, this study serves as the fundamental study for future studies by addressing several research questions as follows:

- What is the overall adherence rate to LPD among CKD patients stage 3 to 5?
- What is the level of dietary knowledge and practices in CKD patient stages 3 to 5?
- What are the anthropometric, body composition, biochemical, and clinical status in CKD patient stage 3 to 5?
- How do CKD patients stage 3 to 5 perceive their stress level and locus of control?
- Among the factors of social-economic level and disease characteristics, parameters of anthropometry, body composition measurements, biochemical data, clinical characteristics, functional status, dietary knowledge and practice, perceived stress level and locus of control, which is the strongest predictor with LPD compliance among CKD patient stage 3 to 5?

1.4 Framework

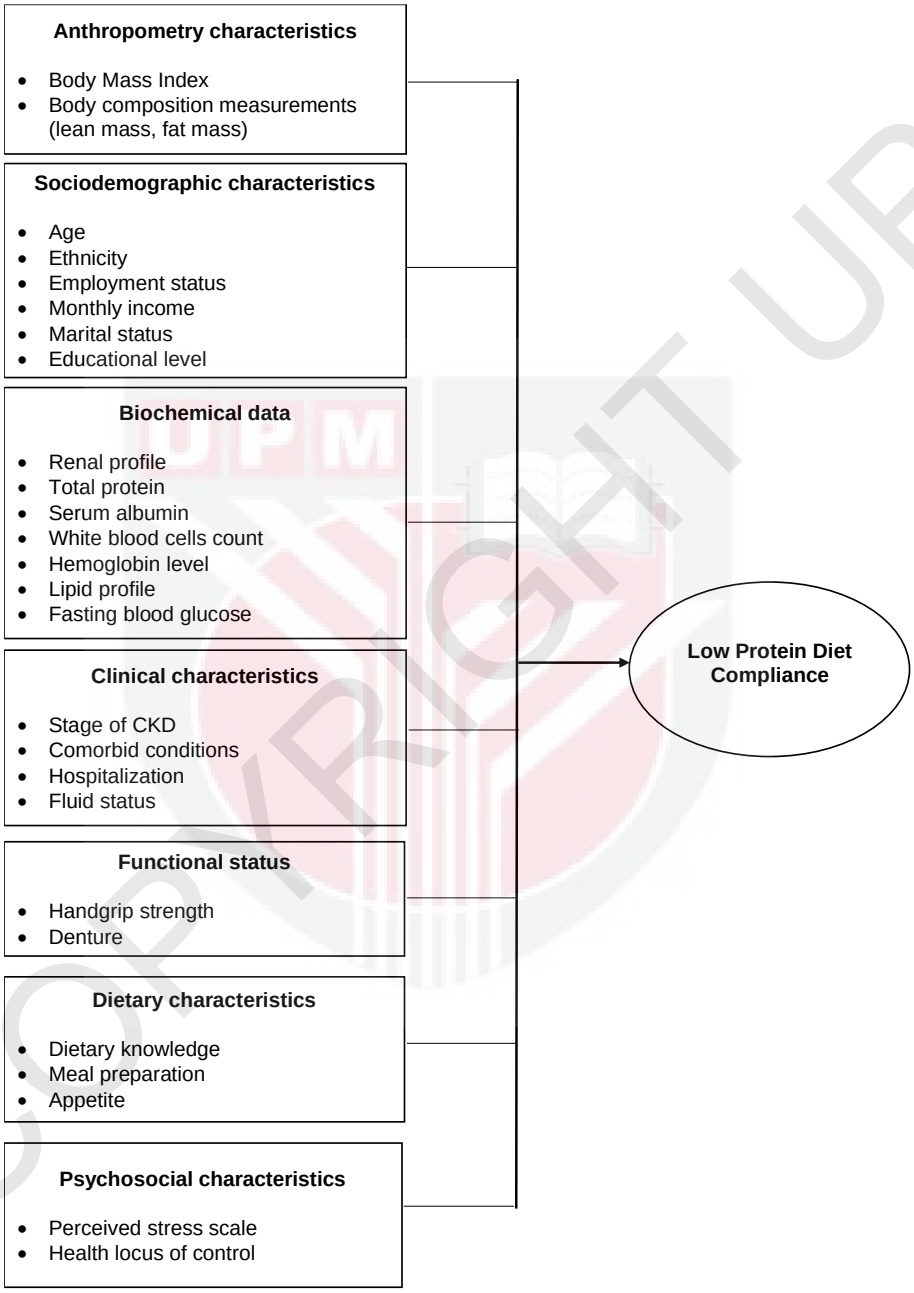

Figure 1.2: Conceptual framework

1.5 Study Objectives

1.5.1 General Objective:

To investigate factors associated with LPD compliances among NDCKD patients in Hospital Pakar Sultanah Fatimah, Muar

1.5.2 Specific Objectives:

- To determine the LPD compliance among NDCKD patients in Hospital Pakar Sultanah Fatimah (HPSF), Muar.
- To identify the social-economic level and disease characteristics, parameters of anthropometry, biochemical characteristics, functional status, dietary knowledge and practice, perceived stress level, and health locus of control among NDCKD patients in HPSF.
- To compare means of social-economic level and disease characteristics, parameters of anthropometry, biochemical data, functional status, dietary knowledge and practice, perceived stress level, and health locus of control with LPD compliance among NDCKD patients in HPSF.
- To determine the relationships of social-economic level and disease characteristics, parameters of anthropometry, biochemical data, functional status, dietary knowledge and practice, perceived stress level, and health locus of control with LPD compliance among NDCKD patients in HPSF.
- To determine the strongest predictor influencing LPD compliance in NDCKD patients in HPSF

1.6.1 Hypothesis:

- There is a significant mean difference between social-economic level and disease characteristics, parameters of anthropometry, biochemical characteristics, functional status, dietary knowledge and practice, perceived stress level, and health locus of control with LPD compliance among NDCKD patients in HPSF.
- There is a significant relationship between social-economic level and disease characteristics, parameters of anthropometry, biochemical characteristics, functional status, dietary knowledge and practice, perceived stress level, and health locus of control with LPD compliance among NDCKD patients in HPSF.
- There is a significant predictor among the independent variables to LPD compliance in NDCKD patients stage 3 and above.

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