UNIVERSITI PUTRA MALAYSIA

CORRELATION BETWEEN SOCIO-DEMOGRAPHIC, NUTRITIONAL AND CLINICAL MARKERS AND POOR SLEEP QUALITY AMONG HEMODIALYSIS PATIENTS IN SIBU, SARAWAK, MALAYSIA

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By

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

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Faculty : Medicine and Health Sciences

Chronic kidney disease is a global health problem with increasing prevalence of patients receiving renal replacement therapies such as peritoneal dialysis, hemodialysis, and transplantation. Poor sleep quality affected 51% to 91% of hemodialysis patients which was relatively more prevalent than general population (33% to 42%). Poor sleep quality was often associated with adverse clinical outcomes such as higher morbidities and affected immunity and diminished quality of life among general population as well as hemodialysis patients, but limited evidence was available on sleep quality and its correlation among hemodialysis patients in local context. This cross-sectional study aimed to determine whether socio-demographic, nutritional and clinical markers could be associated with poor sleep quality among hemodialysis patients in Sibu, Sarawak, Malaysia.

Sleep quality of subjects on both dialysis and non-dialysis days was assessed using Pittsburgh Sleep Quality Index (PSQI). A pre-tested structured questionnaire was used to obtain socio-demographic background while relevant biochemical parameters and clinical parameters were retrieved from medical and dialysis records. Nutritional status of the subjects was assessed using established Dialysis Malnutrition Score (DMS) while anthropometric measurements and hand grip strength (HGS) test were assessed using standardized protocols. Dietary intake was ascertained by three 24-hour dietary recalls (one dialysis day, one non-dialysis day, and one weekend). SPSS version 22.0 was used in statistical analysis of correlation and contribution of variables towards sleep quality.

Multistage sampling was applied where cluster sampling was used in choosing study location and proportionate stratified random sampling was used in selecting subjects. A total of 184 subjects was recruited with mean age of 54.3 ± 12.6 years and comprised of 61% of male. Mean DMS, body mass index, mid-arm muscle

circumference, and HGS were 11.3 ± 2.3, 24.2 ± 4.6 kg/m^2, 26.1 ± 3.9 cm, and 20.9 ± 9.0 kg, respectively. Based on Kidney Disease Outcomes Quality Initiative (K/DOQI) guidelines, approximately 40% of the subjects were hypoalbuminemic, one-third was hypocholesterolemic and hyperphosphatemic, and one-quarter was hyperkalemic. More than three quarters of the subjects had inadequate dietary energy and protein intake. Poor sleepers had significantly higher dietary protein, potassium, and sodium intake ($p < 0.05$). Subjects had a mean dialysis vintage of 56.9 ± 51.1 months, dialysis adequacy (Kt/V) of 1.5 ± 0.3, and interdialytic weight gain (IDWG) of 3.4 ± 1.2%, with 30% of them had excessive IDWG.

Slightly more than half of the subjects were poor sleepers when measured objectively. However, there was only approximately 15% self-rated themselves had poor sleep. Approximately two-third of the subjects had sleep latency more than 15 minutes and sleep duration less than seven hours, respectively. There were significant longer sleep latency and shorter sleep duration among the subjects on non-dialysis day. Six in ten subjects had difficulty with sleep efficiency. Sleep disturbances were evident while use of sleep medication was spared. Daytime dysfunction was seen in 30% of the subjects. Men (r = 0.160, $p = 0.030$), higher DMS (r = 0.152, $p = 0.039$), smaller triceps skinfold (r = -0.147, $p = 0.047$), hyperkalemia (r = 0.161, $p = 0.029$), higher dietary protein (r = 0.157, $p = 0.035$) and sodium (r = 0.162, $p = 0.028$) intakes correlated significantly with higher global PSQI score, hence poorer sleep quality. None of the clinical variables (IDWG, dialysis vintage, and Kt/V) was significantly correlated with sleep quality.

Overall, the multiple regression model explained 14.5% of variance in global PSQI score with calcium intake from supplementation contributed greatest (4.0%), followed by dietary sodium intake (3.1%), serum potassium (2.9%), male sex (2.6%), and the least by HGS (2.0%). Hence, higher calcium intake from supplementation, lower dietary sodium intake, lower serum potassium, and greater HGS were the modifiable risk factors that contributed to better sleep quality among the hemodialysis patients. In conclusion, this study showed a high prevalence of poor sleep quality and variables such as men, widowhood, HGS, malnutrition, lower triceps skinfold, hyperkalemia, higher dietary protein and sodium intake, and lower calcium intake from supplementation contributed significantly to poor sleep quality. The results emphasized the needs of routine nutritional assessment and appropriate intervention in improving the sleep quality among hemodialysis patients.

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

KORELASI ANTARA SOCIO-DEMOGRAFI, PENANDA NUTRISI DAN KLINIKAL DAN KUALITI TIDUR YANG KURANG BAIK DALAM KALANGAN PESAKIT HEMODIALISIS DI SIBU, SARAWAK, MALAYSIA

Oleh

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Penyakit buah pinggang kronik sebagai masalah kesihatan global memberi kesan kepada sebahagian besar populasi dunia dan jumlah pesakit yang menerima rawatan penggantian buah pinggang termasuk dialisis peritonea, hemodialisis, dan pemindahan semakin meningkat. Kualiti tidur yang kurang baik mempengaruhi 51% hingga 91% pesakit hemodialisis dan adalah lebih lazim berbanding dengan populasi umum. Kualiti tidur yang kurang baik membawa kesan buruk kepada hasil klinikal dan kualiti hidup dalam kalangan populasi umum serta pesakit hemodialisis, namun kajian tentang kualiti tidur dan faktor yang berkaitan dengannya adalah sedikit dan terhad dalam kalangan pesakit hemodialisis setempat. Kajian keratan rentas ini bertujuan untuk menentukan bagaimana factor sosio-demografi, pemakanan dan klinikal berkait dengan kualiti tidur yang kurang baik dalam kalangan pesakit hemodialisis di Sibu, Sarawak, Malaysia.

Kualiti tidur pada hari dialisis dan hari bukan dialisis dinilai menggunakan *Pittsburgh Sleep Quality Index* (PSQI). Borang soal selidik berstruktur yang telah diuji digunakan untuk mengumpul data tentang latar belakang sosio-demografi sementara parameter biokimia dan klinikal yang berkaitan diperoleh dari rekod perubatan dan dialisis. Status pemakanan dinilai dengan menggunakan *Dialysis Malnutrition Score* (DMS). Manakala, ukuran antropometrik dan ujian kekuatan genggaman (HGS) dinilai mengikut protokol piawaian. Pengambilan makanan dinilai menggunakan cara ingatan diet 24 jam selama 3 hari (satu hari dialisis, satu hari bujan dialisis, dan satu hari minggu). SPSS versi 22.0 digunakan untuk menganalisis perkaitan dan sumbangan pembolehubah terhadap kualiti tidur.

Pensampelan pelbagai peringkat telah digunakan di mana pensampelan kluster digunakan untuk memilih lokasi pengajian dan pensampelan rawak berstrata

berkadar digunakan untuk memilih subjek. Sejumlah 184 subjek mengambil bahagian dalam kajian ini. Subjek terdiri daripada 61% lelaki dan min umur populasi kajian ialah 54.3 ± 12.6 tahun. Min DMS, indeks jisim tubuh, lilitan otot pertengahan lengan, dan HGS adalah 11.3 ± 2.3, 24.2 ± 4.6 kg/m^2, 26.1 ± 3.9 cm, dan 20.9 ± 9.0 kg masing-masing. Berdasarkan panduan *Kidney Disease Outcomes Quality Initiative* (K/DOQI), kira-kira 40% daripada subjek mempunyai albumin yang rendah, satu pertiga yang kolesterol rendah dan fosforus tinggi, dan satu perempat mempunyai kalium yang tinggi. Lebih daripada tiga suku subjek mempunyai pengambilan tenaga dan protein yang tidak mencukupi. Pengambilan protein, kalium, dan natrium adalah lebih tinggi pada subjek yang tidur kurang baik ($p < 0.05$). Purata tempoh dialisis ialah 56.9 ± 51.1 bulan, kecekapan dialisis (Kt/V) sebanyak 1.5 ± 0.3, dan berat badan antara dialisis (IDWG) sebanyak 3.4 ± 1.2% di mana 30% daripada mereka mempunyai IDWG berlebihan.

Lebih daripada separuh subjek mempunyai kualiti tidur yang kurang baik secara objektif manakala hanya kira-kira 15% menilai sendiri mempunyai kualiti tidur yang kurang baik. Kira-kira dua pertiga daripada subjek mempunyai kependaman tidur lebih daripada 15 minit dan jangka waktu tidur kurang daripada tujuh jam. Kependaman tidur adalah lebih panjang dan jangka waktu tidur adalah kurang pada hari bukan dialisis. Enam dari sepuluh subjek mempunyai kecekapan tidur yang kurang. Subjek sering mengalami gangguan tidur tetapi jarang menggunakan ubat tidur. Gangguan pada siang hari terdapat dalam 30% subjek. Lelaki ($r = 0.160$, $p = 0.030$), skor DMS yang lebih tinggi ($r = 0.152$, $p = 0.039$), lipatan kulit pada triceps yang lebih kecil ($r = -0.147$, $p = 0.047$), dan pengambilan protein ($r = 0.157$, $p = 0.035$) dan natrium ($r = 0.162$, $p = 0.028$) yang lebih banyak berkait signifikasi dengan skor PSQI yang lebih tinggi. Parameter klinikal terdapat tiada kaitan dengan skor PSQI. Sebaliknya, serum protein yang rendah, kalium yang tinggi, dan pengambilan lemak dan natirum yang lebih tinggi berkaitan dengan kualiti tidur yang kurang baik. Serum kalium dan fosforus yang tinggi, pengambilan protein, lemak, dan fosforus yang tinggi berkait rapat dengan kependaman tidur yang lebih panjang. Lelaki berkait dengan jangka waktu tidur yang pendek. Lelaki, berusia, skor DMS yang tinggi, dan pengambilan natrium yang tinggi berkait dengan kecekapan tidur yang rendah. Pengambilan karbohidrat yang rendah dan lemak yang tinggi berkait dengan gangguan tidur yang lebih kerap. Serum kalsium yang tinggi berkait dengan penggunaan ubat tidur dan gangguan siang hari yang kerap. Skor DMS yang tinggi juga berkait dengan gangguan siang hari.

Model regresi berganda menjelaskan 14.5% variasi terhadap skor PSQI global melalui pengambilan kalsium dari suplemen (4.0%), pengambilan natrium daripada diet (3.1%), serum kalium (2.9%), lelaki (2.6 %), dan HGS (2.0%). Ini menunjukkan pengambilan kalsium yang lebih tinggi daripada suplemen, pengambilan natrium yang lebih rendah, serum kalium yang lebih rendah, dan HGS yang lebih kuat merupakan faktor risiko dapat diubahsuai yang menyumbang kepada kualiti tidur yang lebih baik. Secara keseluruhannya, kajian ini menunjukkan kelaziman kualiti tidur yang kurang baik yang tinggi. Lelaki, janda/duda, HGS, kekurangan zat makanan, lipatan kulit pada triceps yang lebih kecil, serum kalium yang tinggi, pengambilan protein dan natrium yang lebih tinggi, dan pengambilan kalsium yang lebih rendah daripada supplemen memberi sumbangan yang ketara terhadap kualiti

tidur yang kurang baik. Keputusan ini menekankan keperluan penilaian status nutritsi yang kerap antara pesakit hemodialisis dan intervensi pemakanan yang sesuai harus dilakukan untuk meningkatkan kualiti tidur.

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

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LIST OF ABBREVIATIONS

ACR	Albumin-to-creatinine ratio
AER	Albumin excretion rate
BMI	Body mass index
BMR	Basal metabolic rate
BUN	Body urea nitrogen
CCI	Charlson Comorbidity Index
CKD	Chronic kidney disease
DD	Daytime dysfunction
DEXA	Dual Energy X-Ray Absorptiometry
DEI	Dietary energy intake
DMS	Dialysis Malnutrition Score
DPI	Dietary protein intake
EBPG	European Best Practice Guideline
EI	Energy intake
ESRD	End stage renal disease
ESS	Epworth sleepiness scale
GFR	Glomerular filtration rate
Hb	Hemoglobin
HD	Hemodialysis
HDD	Hemodialysis day
HGS	Handgrip strength
IDWG	Interdialytic weight gain
IGF-1	Insulin-like growth factor-1
ISRNM	International Society of Renal Nutrition and Metabolism
KDIGO	Kidney Disease: Improving Global Outcomes
K/DOQI	Kidney Disease Outcomes Quality Initiative
Kt/V	Dialysis adequacy
MAMC	Mid-arm muscle circumference
MIS	Malnutrition Inflammation Score
MTSL	Multiple test sleep latency
MUAC	Mid-upper arm circumference
NHDD	Non-hemodialysis day
NREM	Non-rapid eye movement
PAL	Physical activity level
PEW	Protein-energy wasting
PSQI	Pittsburgh Sleep Quality Index
REM	Rapid eye movement
RLS	Restless leg syndrome
RMC	Rejang Medical Centre
RRT	Renal replacement therapy
SD	Sleep duration
SDB	Sleep disturbance

SE	Sleep efficiency
SGA	Subjective Global Assessment
SJAM-KPS	St. John Ambulance Malaysia – *Kawasan Pantai* Selangor
SKF	Sibu Kidney Foundation
SL	Sleep latency
SM	Use of sleep medication
SSQ	Subjective sleep quality
TSF	Triceps skinfold
WHO	World Health Organization

GLOSSARY OF TERMS

Sleep quality: Sleep quality of this study employed Pittsburgh Sleep Quality Index (PSQI) which provided a measure of global sleep quality of the past month based on a subject's perception on an array of sleep measures, including overall sleep quality, sleep onset latency, sleep duration or total sleep time, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction.

Subjective sleep quality: Perception of an individual on the satisfaction of sleep experience, integrating aspects of sleep initiation, sleep maintenance, sleep quantity, and refreshment upon awakening (Kline, 2013b).

Sleep latency: The amount of time needed to fall asleep (Hall, 2013).

Sleep duration: The total amount of sleep obtained, either during the nocturnal sleep episode or across the 24-h period (Kline, 2013a). In this study, it was defined as total sleep time where time in bed minus the amount of sleep latency and amount of time spent awake during the night (Hall, 2013).

Sleep efficiency: A proportional sleep continuity measure which referred to the percentage of time in bed spent asleep. The calculation was as follow: (time spent asleep/ time in bed) x 100 (Hall, 2013).

Sleep disturbances: Sleep disruptive events such as spontaneous arousal, apnea, nightmare, physical pain etc., which interrupted an individual's sleep (Krystal & Edinger, 2008).

Daytime dysfunction: Loss in enthusiasm towards things and affected daytime function such as driving, eating meals, or engaging in social activity due to excessive daytime sleepiness as a result of frequent sleep disruption (Luyster, 2013).

CHAPTER 1

INTRODUCTION

1.1 Background

Chronic kidney disease (CKD) is a serious public health problem (Jha et al., 2013) and ranked as the 12th most common cause of death and the 17th leading cause of global years of life lost in the 2015 Global Burden of Disease Study (Wang et al., 2016). Defined as a progressive loss of kidney function and performance of nephrons over a period of time (Ebrahimzadehkor, Dorri, & Yapan-Gharavi, 2014), chronic kidney disease can be classified into different stages based on estimated glomerular filtration rate (GFR). End stage renal disease (ESRD) is the most advanced stage of CKD where kidneys function below 10 to 15% or GFR is less than 15 ml/min/1.73 m^2 (Kidney Disease: Improving Global Outcomes (KDIGO) 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease). At this stage, renal replacement therapy (RRT) which partially replaces the renal functions is required to sustain life. Damage caused by CKD is non-reversible and affects health, nutritional status, and quality of life of patients significantly (Fonseca et al., 2016).

Global statistics shows incline number of ESRD cases undergo RRT. In the United States, the prevalence of treated ESRD in year 2015 was 2,138 pmp (per million population), with an increment of 3% since 2014 and 35% since 2005 (United States Renal Data System, 2017). In Malaysia, the prevalence of treated ESRD patients had increased from 562 pmp in 2006 to at least 1,220 pmp in 2015, with the increment of more than two-fold, in just a decade (Wong & Goh, 2017). The treatment rate in Malaysia had increased steeply and was relatively higher than the rate in developed countries with higher gross domestic product per capita, such as Australia (968 pmp in 2015) and New Zealand (950 pmp in 2015) (United States Renal Data System, 2017). Meanwhile, dialysis patients in Malaysia had doubled from 105 pmp in 2005 to 261 pmp in 2015 (United States Renal Data System, 2017). This is in parallel with the increased prevalence of diabetes mellitus in the nation as reported in the most recent national surveillance of National Health and Morbidity Survey (Institute for Public Health (IPH), 2015).

Common RRTs available for ESRD patients include peritoneal dialysis, hemodialysis (HD), and renal transplantation. Among these, HD is the most preferred treatment modality. Worldwide, there was approximately 90% of dialysis patients received HD treatment (Karopadi, Mason, Rettore, & Ronco, 2013; Macneill, Casula, Shaw, & Castledine, 2016; United States Renal Data System, 2017). A similar scenario is documented in Malaysia (Wong & Goh, 2017), including Sarawak. In Sarawak, the prevalence of patients receiving HD treatment had increased from 840 in 2005 to 2,076 in 2015, with a prevalence rate of 788 pmp in 2015 (Wong & Goh, 2017). Hemodialysis treatment is preferable than other RRTs as facilities on peritoneal dialysis such as centers and trained health workers in providing peritoneal dialysis services and education are less accessible than HD in Malaysia. Besides, high

mortality risk associated with peritonitis could have also contributed to the choice of HD as the modality treatment method among the ESRD patients. On the other hand, despite kidney transplantation is the optimal therapy for ESRD patients, over the ensuing years, the transplant rate has remained low with an average of 60 transplants annually (Wong & Goh, 2017), attributed to cultural and religious barriers, increased accessibility to dialysis facilities and challenge to match biocompatible kidney for transplantation.

1.2 Problem Statement

There is steadily increase in the incidence of HD patients in Malaysia. Various health problems that are prominent among local HD patients include malnutrition or protein-energy wasting (PEW) (Harvinder et al., 2016), inadequate dietary intake or poor appetite (Nor Baizura, Chan, Zalilah, & Choo, 2013; Sahathevan et al., 2015), hyperphosphatemia, excessive interdialytic weight gain (IDWG) (Ho & Chan, 2018), poor quality of life (Nor Baizura et al., 2013), psychological disorders, sleep disorders (Ramatillah, Sulaiman, Khan, & Ong, 2017), and others. Frequent sleep complaints among HD patients include insomnia (Ezzat & Mohab, 2015; Sabry et al., 2010), waking up early (Chen et al., 2006), excessive daytime sleepiness (Chen et al., 2006), restless leg syndrome (Sabry et al., 2010), and sleep apnea (Chen et al., 2006; Sabry et al., 2010). Among all, nocturnal and daytime sleepiness were associated with negative impacts on general health status, life satisfaction, emotion, and work performance (Garbarino, Lanteri, Durando, Magnavita, & Sannita, 2016). In Malaysia, government remains as the largest institutional provider for dialysis treatment cost, drugs and other healthcare services to dialysis patients (Wong & Goh, 2017). The remarkable growth in ESRD patients and disease related health complications such as poor sleep quality inevitably places an enormous human, economic and social heavy burden on the healthcare system of Malaysia. Therefore, there is an urgent need to address the poor sleep quality and its determinants among HD patients, before appropriate intervention can be embarked to reduce the poor sleep related economic burden on the government.

In recent years, morbidity and mortality rates among HD patients had markedly reduced with the advancement in dialysis therapy and treatment (Chang & Yang, 2011). Enormous intervention programs were carried out in improving the nutritional problems such as malnutrition, hyperphosphatemia, and inadequate dietary intake. However, poor sleep quality which was frequently reported among dialysis patients received little attention locally. Globally, high prevalence of poor sleep quality (51 to 91%) (Abdelwhab, Kamel, & Noshey, 2010; Chang & Yang, 2011; Firoz, Shafipour, Jafari, Hosseini, & Charati, 2016; Iliescu, Yeates, & Holland, 2004; Köse, Turgutalp, Kiykim, & Çelik, 2014; Masoumi, Naini, Aghaghazvini, Amra, & Gholamrezaei, 2013; Mehrabi, Sarikhani, & Roozbeh, 2017; Sabet, Naghizadeh, & Azari, 2012; Trbojević-Stanković et al., 2014; Zeydi et al., 2014) and sleep problems (50 to 80 %) (Abdelwhab et al., 2010; Chen et al., 2006; Iliescu et al., 2003; Sabet et al., 2012; Sabry et al., 2010) were noticed among dialysis patients, such information however is scarce at the local context.

Earlier studies showed a majority of dialysis patients encountered with sleeping problems had poor quality of life (Elder et al., 2008; Fonseca et al., 2016; Roumelioti

et al., 2011; Saad et al., 2015), malnourished (Bilgic et al., 2012), and increase morbidity and mortality (Fonseca et al., 2016; Mehrabi et al., 2017). Sleep problems especially sleep apnea had been found to increase the cardiovascular-related outcomes such as systemic hypertension, coronary artery disease, and cerebrovascular disease in kidney disease patients (Abdelwhab et al., 2010). Poor sleep quality may also negatively affect immunity and cause death in patients with ESRD (Sabbatini et al., 2008; Sabet et al., 2012). Furthermore, quality of sleep of HD patients had a strong association with mental and physical well-being, where poor sleepers had lower health-related quality of life (Elder et al., 2008; Iliescu et al., 2003; Roumelioti et al., 2011). In view of poor sleep quality has tremendous health implications, this signifies more research is deem needed to identify factors associated with sleep quality among dialysis patients.

The etiology of poor sleep quality among dialysis patients is multifactorial which include psychological factors such as anxiety, fatigue, and depression (Afsar & Elsurer, 2013; Danielle, Mahamat, Francois, Marie-Patrice, & Gloria, 2017), and physical disturbances such as high blood pressure, muscle cramps, and electrolytes imbalances (Sabry et al., 2010). Metabolic factors such as older age, female (Chang & Yang, 2011), overweight or obesity (Afsar & Elsurer, 2013), anemia, hypoalbuminemia, bone pain, pruritus (Abdelwhab et al., 2010), uremic toxins (Dryl-Rydzyńska, Sak, & Książek, 2014), hyperphosphatemia (Unruh et al., 2006), malnutrition (Bilgic et al., 2012), and volume overload were reported to be associated with poor sleep quality. Clinical parameters such as dialysis adequacy and longer dialysis vintage had been found to be associated with poor sleep quality in other populations (Chang & Yang, 2011; Einollahi, Motalebi, Rostami, Nemati, & Salesi, 2015; Masoumi et al., 2013), while how IDWG, being a well-recognized clinical parameters may influence sleep quality among HD patients is yet to be explored. To the best of knowledge, there is no previous study conducted to address how the above factors may influence sleep quality among hemodialysis patients at the local context.

Despite several factors were found to be associated with poor sleep quality, interaction between dietary nutrients intake and poor sleep quality has yet to be established among dialysis population. Only a few observational studies tried to examine the association between habitual sleep patterns and diet in general population, where most of the studies focused on sleep duration (Lai & Say, 2013; Lindseth & Murray, 2016; Nishiura, Noguchi, & Hashimoto, 2010; Peuhkuri, Sihvola, & Korpela, 2012). Peuhkuri et al. (2012) reported sleep duration could modify dietary choices, dietary patterns, and dietary consumption of a person or vice versa. For instance, post-menopausal women who had higher consumption of dietary fat slept less, as verified by actigraphy (Grandner, Kripke, Naidoo, & Langer, 2010). Study in India found insomniac adults had significant lower total calorie, protein, carbohydrate intake compared to normal sleepers (Zadeh & Begum, 2011). Although results from observational studies suggested a relationship between sleep duration and dietary factors may exist, such relationship is not well understood neither among general population, nor among HD patients. In addition, plausible data is available on how dietary intakes may affect other components of sleep including sleep disturbances, sleep latencies, or sleep efficiency.

Sleep problem is one of the common psychological disorders among HD patients that is often overlooked as patients may not manifest symptoms. Among the stated etiologies of poor sleep quality in dialysis population, nutritional problems which include malnutrition or PEW, inadequate dietary intake, poor compliance to dietary restriction, and clinical problem of excessive IDWG were prevalent. When the associations between these prominent factors and sleep are established, precise and effective actions could be carried out in combating those problems associated with sleep. Meanwhile, despite studies had consistently documented poor sleep quality were associated with numerous clinical consequences, most of the available studies involved Caucasians (Dryl-Rydzyńska et al., 2014; Trbojević-Stanković et al., 2014) and Asians (Bilgic et al., 2012; Chang & Yang, 2011; Einollahi et al., 2015), with none local study available to date. As sleep problem is multifactorial in etiology, identifying the contributors by applying multifactorial analysis is empirical. For the best of knowledge, most of the previous studies employed bivariate analysis, which limit the possibilities of certain factors that contributed significantly to poor sleep quality.

With these research gaps in mind, the following are the research questions to enable the topic to be fully explored:

1. What is the prevalence of poor sleep quality among HD patients in Sibu, Sarawak?
2. Are there any difference on socio-demographic factors, nutritional and clinical markers have differences between good sleepers and poor sleepers among HD patients?
3. Are socio-demographic factors, nutritional and clinical markers correlate with sleep quality among HD patients?
4. What is/ are the significant contributor(s) of poor sleep quality among HD patients?

1.3 Significance of Study

This study aims to investigate the factors that might associate with poor sleep quality among HD patients, namely socio-demographic factors, nutritional markers (nutritional status, anthropometric measurements, handgrip strength, biochemical parameters, dietary intake), and clinical parameters. Various documentations reported high prevalence of poor sleep quality among HD patients (Abdelwhab et al., 2010; Firoz et al., 2016; Masoumi et al., 2013; Mehrabi et al., 2017). There is however very limited study available to delineate factors associated with poor sleep quality among HD patients in Malaysia. Meanwhile, studies on prevalence of poor sleep quality among HD patients in Sibu, Sarawak are scarce. This signifies the importance of such study in the local context. Such information will allow health care professionals such as medical practitioners, pharmacists, psychologists, nurses, and dietitians as well as other researchers to put more efforts in improving sleep quality, at the same time to optimize clinical outcomes of the HD patients.

Furthermore, this study can contribute in providing baseline data regarding sleep quality of local HD patients. In addition, the findings of this study enable researchers

to increase the understanding and knowledge on the sleep quality of HD patients in Sibu, Sarawak. The detailed knowledge is important in implementing appropriate and effective activities or programs in order to improve sleep quality among HD patients in Malaysia.

1.4 Objectives of Study

General objective

To determine factors that associated with poor sleep quality among HD patients in Sibu, Sarawak.

Specific objectives

1. To identify the socio-demographic factors (age, sex, ethnicity, educational level, marital status, household size, and household monthly income), nutritional markers (nutritional status score, anthropometric measurements, handgrip strength, biochemical parameters, and dietary intake), clinical markers (IDWG, dialysis vintage, dialysis adequacy, co-morbodity), and sleep quality among HD patients.
2. To determine the prevalence of poor sleep quality among HD patients.
3. To compare socio-demographic factors, nutritional markers, clinical markers, and sleep components between good sleepers and poor sleepers.
4. To determine the correlation of sleep quality with socio-demographic factors, nutritional markers, and clinical markers among HD patients.
5. To determine the contributors of poor sleep quality in HD patients.

1.5 Research Hypotheses

1. There were significant differences on socio-demographic factors, nutritional markers, clinical markers, and sleep components between good sleepers and poor sleepers.
2. There were significant correlations of sleep quality with socio-demographic factors, nutritional markers, and clinical markers among HD patients.
3. There were significant contributors of poor sleep quality among HD patients.

1.6 Conceptual Framework

Figure 1.1 showed the conceptual framework of this study. Older age (Chang & Yang, 2011; Firoz et al., 2016) and women (Chang & Yang, 2011) were associated with poor sleep quality. According to Mehrabi et al. (2017), higher body mass index (BMI) was associated with poorer sleep quality. Bilgic et al. (2012), Sabry et al. (2010) and Zeydi et al. (2014) reported that poor sleep quality was associated with anemia, hypoalbuminemia, hyperphosphatemia, and malnutrition. Inadequate dialysis was also associated with poor sleep quality among HD patients (Afsar & Elsurer, 2013). The present study examined how demographic and socioeconomic factors, nutritional

markers, and clinical markers were associated with sleep quality among HD patients, with the latter being the dependent variable of this study.

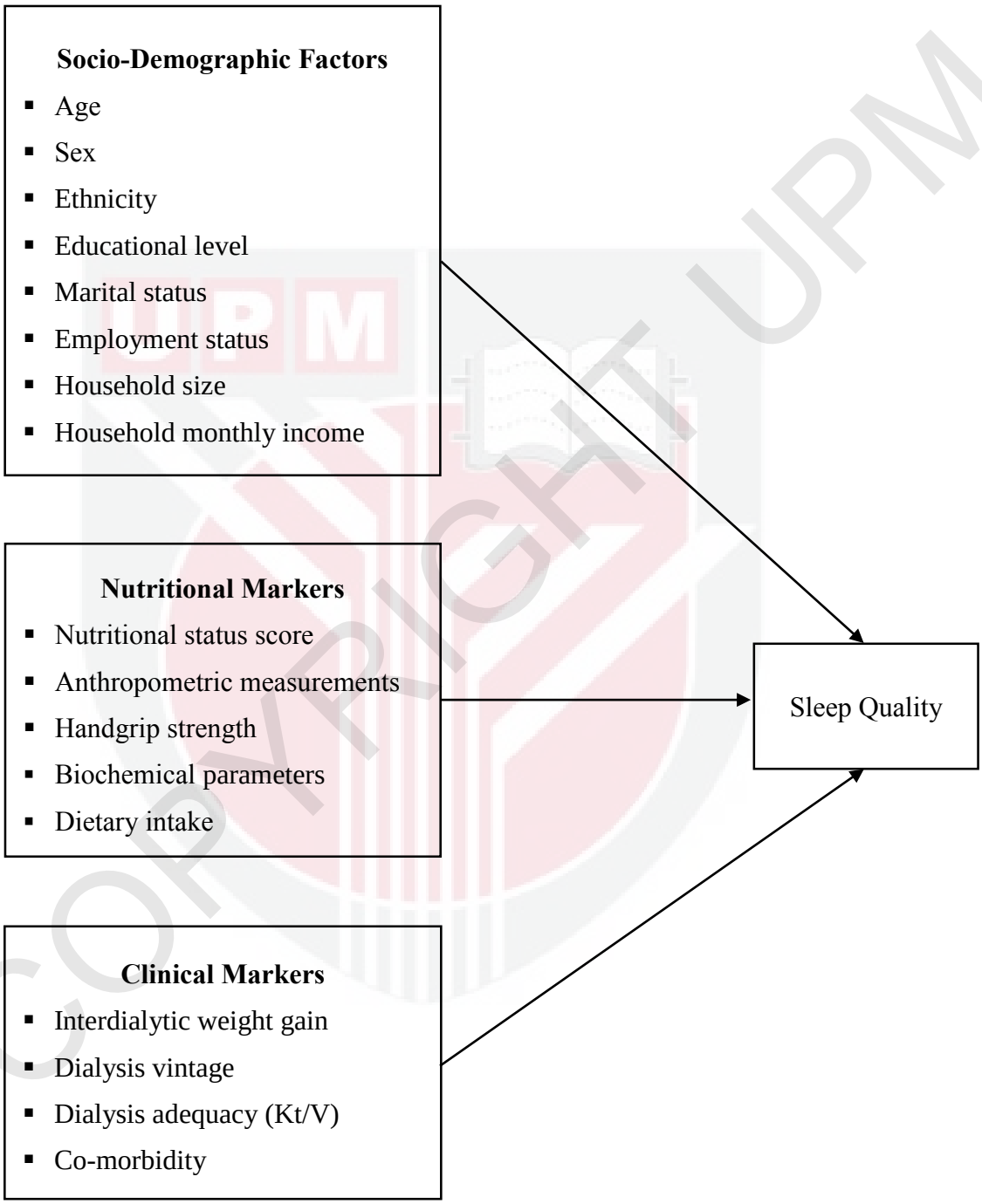

Figure 1.1: Contribution of Socio-demographic Factors, Nutritional and Clinical Markers towards Poor Sleep Quality among Hemodialysis Patients

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