UNIVERSITI PUTRA MALAYSIA

MALNUTRITION STATUS AND ITS ASSOCIATED FACTORS AMONG PRE-OPERATIVE SURGICAL PATIENTS IN PUBLIC HOSPITAL

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BY

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A project submitted as a partial fulfilment of the requirement for the degree of

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ABSTRACT

MALNUTRITION STATUS AND ITS ASSOCIATED FACTORS AMONG PRE-OPERATIVE SURGICAL PATIENTS IN PUBLIC HOSPITAL

Nurul 'Aqilah Binti Hasan Ashaari

Malnutrition in pre-operative surgical patients is associated with adverse outcomes which. This study aims to determine the malnutrition status and its factors associated including sociodemographic factors, nutritional status (anthropometry measurements, biochemical data and 24-hour diet recall) and medical history among pre-operative surgical patients. This was a cross-sectional study involving 39 elective general and gynaecology surgical patients. Socio-demographic background was obtained through an interviewed questionnaire. Medical history was taken from medical record of the patients. Diet history was taken through interview of 24-hour diet recall while malnutrition status was assessed using PG-SGA grading scores. The prevalence of malnutrition status was 20.5% while 74.4% of pre-operative surgical patients were found to be well-nourished. A total of 39 patients with mean age of 46.03 ± 16.77 years participated in this study. It was found that age (r=0.517, p=0.001**), medical history (p=0.004**), dietary intake; energy and protein intake (r=-0.531, p=0.001**; r=-0.371, p=0.019**) were associated with malnutrition status among pre-operative surgical patients. Number of patients who are malnourished are relatively low especially patients who are well-nourished, however early identification of patients who are at risk of malnutrition should be monitored and do proper intervention to prevent post-operative complications.

ABSTRAK

STATUS MALNUTRISI DAN FAKTOR-FAKTOR YANG BERKAITAN DENGAN PESAKIT PEMBEDAHAN PRA-OPERATIF DI HOSPITAL AWAM

Nurul ‘Aqilah Binti Hasan Ashaari

Malnutrisi pada pesakit pembedahan pra-operasi dikaitkan dengan hasil yang buruk. Kajian ini bertujuan untuk mengetahui status kekurangan zat makanan dan faktor-faktornya yang berkaitan termasuk faktor sosiodemografi, status pemakanan (pengukuran antropometri, data biokimia dan penarikan balik diet 24 jam) dan sejarah perubatan di kalangan pesakit pembedahan pra-operasi. Ini adalah kajian keratan rentas yang melibatkan 39 pesakit pembedahan elektif dan ginekologi. Latar belakang sosio-demografi diperoleh melalui soal selidik yang ditemuramah. Sejarah perubatan diambil dari rekod perubatan pesakit. Sejarah diet diambil melalui kaedah temu ramah “24-hour diet recall” sementara status kekurangan zat makanan dinilai menggunakan skor penilaian PG-SGA. Kelaziman status kekurangan zat makanan adalah 20.5% sementara 74.4% pesakit pembedahan sebelum operasi didapati berkhasiat dengan baik. Seramai 39 pesakit dengan usia min 46.03 ± 16.77 tahun mengambil bahagian dalam kajian ini. Didapati bahawa umur (r = 0,517, p = 0,001 **), sejarah perubatan (p = 0,004 **), pengambilan makanan; pengambilan tenaga dan protein (r = -0.531, p = 0.001 **; r = -0.371, p = 0.019 **) dikaitkan dengan status kekurangan zat makanan di kalangan pesakit pembedahan pra-operasi. Bilangan pesakit yang kekurangan nutrisi agak rendah terutama pesakit yang kekurangan zat makanan, namun pengenalpastian awal pesakit yang berisiko kekurangan zat makanan harus dipantau dan melakukan intervensi yang tepat untuk mencegah komplikasi pasca operasi.

CHAPTER 1

INTRODUCTION

1.1 Background

According to World Health Organization (WHO), malnutrition can be defined as deficiencies, excesses or imbalance or imbalances in a person's intake of energy and/or nutrients. The term malnutrition addresses 3 broad groups of conditions, which is undernutrition, micronutrient-related malnutrition and overnutrition (Maleta, 2006). Apart from that, European Society for Clinical Malnutrition Nutrition and Metabolism, malnutrition means "a state resulting from lack of intake or uptake of nutrition that leads to altered body composition (decreased fat free mass) and body cell mass leading to diminished physical and mental function and impaired clinical outcome from disease". Malnutrition can result from starvation, disease or advanced ageing (e.g. >80 years), alone or in combination (Cederholm et al., 2017). Example of diseases that may contribute to malnutrition in surgical include peptic ulcers, pancreatitis, gall bladder, inflammatory bowel diseases, neoplasm and gynaecological issues (Leandro-Merhi & de Aquino, 2014).

Malnutrition especially for elderly are at risk the most in hospitals (Cerri et al., 2015), however, malnutrition includes most population that is being hospitalized. Based a study conducted by Rojer et al., (2016), the healthy young, the healthy old, the geriatric outpatients and the acutely ill middle-aged patients was screened being at risk of malnutrition. The prevalence of malnutrition ranged from 0% in the healthy young, 0.5% in healthy old individuals, 6% in the geriatric outpatients to 14% in the acutely ill middle-aged patients. Preoperative evaluation in terms of nutritional assessment is very important but often neglected by the healthcare professionals. As a result, malnutrition is clearly associated with undesired surgical outcomes especially adults that undergo abdominal surgery (Strine et al., 2018).

The cause of malnutrition for surgical patients is multifactorial. The common cause of malnutrition is the reduced of dietary intake, absorption of macronutrients and micronutrients, increased losses or altered requirements as well as increased energy expenditure for recovering in diseases (Saunders & Smith, 2010). Diet problems, digestive and stomach condition may alter the nutrient requirements of an individual. Changes in nutrient requirement also due to disease processes and drug-nutrient interaction (Khan et al., 2017). Several complications can cause pre-operative surgical patients who are malnourished. According to (Mignini et al., 2018), surgical procedures either major or minor may alter the physiology due to inflammatory response and stimulation of body catabolism. Hence, surgery is strongly associated with malnourishment and may be linked with undesired post-operative outcome. In other word, the proper nutrition should be monitored during pre-operative to ensure the nutritional status of surgical patients during their stay in hospital. (Prin et al., 2017)

Malnutrition for operative surgical patients can lead to many complications. Pre-operative clinical conditions especially those with cancer in gastrointestinal and esophageal issues may have the highest prevalence of malnourishment due to admittance of nutritional conditions, comorbidities, elderly, malabsorption, dysphagia as well as gastric stasis occurrence (Mighini et al, 2018). Patients who are at risk of malnutrition will have longer stay in hospital because the complication may include prolonged treatment, increasing of the level of morbidity and mortality and increased hospital costs (Loncar et al., 2019). According to Hu et al., (2015) complications of postoperative morbidities outcomes are superficial surgical site infection, surgical site infection, wound disruption, urinary tract infection, blood transfusion, sepsis, septic shock, re-intubation and returning to operating room. In short, malnutrition is a significant problem among surgical patients.

The assessment of nutritional status is important because it affects post-operative clinical results. The early recognition can be done to avoid this problem to occur. According to

American Society of Parenteral and Enteral Nutrition (ASPEN), several recommendations to assess nutritional status include anthropometric and laboratory parameters and dietary intake of the patients (Perera, 2002)

By determining sociodemographic factors such as age, sex and gender, occupation, incomes and ethnicity are essential for health professionals to define qualitative and quantitative strategies in order to enhance patient care especially in preventing complications as well assessing them to rehabilitation. For example, these attributes are essentially important to plan patient care in ICU to determine the origin of patients, morbidity, length of stay and many more (I et al., 2016). This is similarly important in taking care surgical patients as well (Anderson et al., 2016).

Comorbidity can be defined as coexistence of chronic condition or disorders in addition to a primary disease of treatment is common among cancer surgical patients. (Sun et al., 2017). In surgery, the presence of comorbidity in patients may increase and complicate surgical risk, perioperative care as well as prognosis recovery after surgical procedures (Sun et al., 2017). Comorbidities include diabetes mellitus, chronic obstructive pulmonary disease (COPD), cardiovascular diseases and neurological comorbidity which include psychological issue. This study has been conducted in Europe and was found out that there is high correlation between comorbidities and higher postoperative complications and mortality (Sun et al., 2017).

Anthropometry measurements are important to assess the nutritional status especially among hospitalized surgical patients. Undernutrition can happen among disease-related malnutrition in which even patients with high body mass index (BMI) or obese patients to be undernourished (Guenter et al., 2015). According to Allard et al., (2014) BMI is not a good predictive method to assess nutritional status because it might be influenced by edema. From the study conducted, prevalence of malnutrition that associates with BMI is not sensitive

enough because only 9% of hospitalized patients were in the underweight BMI (Allard et al., 2014). Allard et al., (2016) also stated that BMI is not protective in terms of nutrition as they might develop sarcopenia which is hard to be detected.

Biochemical markers such as albumin and lymphocytes are commonly used by healthcare practitioners to assess the nutritional status of patients. According to (Morey et al., 2016), the level of albumin to measure malnutrition is <3.5 g/dl while total lymphocytes is < 1500 cell/mm^3 . Using biomarkers such as albumin and total lymphocyte count is a good method to assess nutritional status to predict the risk of postoperative complications. According to (Chiarelli et al., 2019), low counts of lymphocytes (lymphocytopenia) is highly associated with complications after intestinal surgery.

Generally, patients who are undergoing surgical procedures need high intake of energy and protein as hormones such as cortisol, glucagon and catecholamines increased as counter regulatory hormones. Destruction of muscle body results in reduction of energy supplies due to catabolic effects which may prolong the hospital stay after surgery is procedure is carried out (Andonovska et al., 2016). Indeed, right before surgical procedure, the patients will be asked to fast in order to prevent regurgitation or nausea, however, ESPEN recommends that do not starve overnight and take carbohydrates instead. This is because starvation will just increase the inflammatory markers.

Malnutrition status is measured by using patient-generated subjective global (PGSGA) which is valid in surgical patients. PG-SGA can be categorized into three groups based on interview information on weight, dietary pattern, change in physical ability and physical examination by observing subcutaneous fat, muscle loss and presence of edema or ascites. Patients who scored in group A are categorized as nourished, B are moderately malnourished or at risk of malnourished and C are severely malnourished (Kahokehr et al.,

2010). PG-SGA can also be used as symptoms tools for malnutrition and able to identify patients who are at risk by optimizing predictive variables preoperatively as well as consequences of malnutrition may be prevented.

1.2 Problem Statement

Malnutrition cases is a serious problem and need to be prevented especially patients who are undergoing surgical procedures. This is because the consequences of the surgery outcomes may include poor wound healing, falls, high death rates and increased hospital bills due to longer stay in hospital. However, unfortunately, the malnutrition remained high prevalence cases because this case is often underdiagnosed and untreated (Palmero et al, 2017). Malnutrition can be defined as the imbalance between intake and requirement which results in altered metabolism, impaired function and loss of body mass or a state of nutrition in which imbalance of deficit in energy, protein, and other nutrients causes measureable adverse effects on tissue or body form (Norman et al., 2008). According to Norman et al., (2008) prevalence of malnutrition in hospital ranges between 20% to 50% based on criteria or method used to measure the nutritional status and patient's characteristics.

In hospitalized patients, the problem of malnutrition in terms on protein-energy is common and often unrecognized during their stay in hospital and results in high risk of clinical outcomes (Flood et al., 2014). According to Holst et al., (2017), inadequate monitoring of nutrition intake among hospitalized patients is hard to achieve. Based on ESPEN recommendations, in order to reduce the nutritional risk patients, their nutritional requirement should able to reach up to 75%. Flood et al., (2014) also reported that some healthcare team sometimes are not able to recognize if the patient's nutrient intake is inadequate. According to a local study conducted by Latiff et al., (2016) in Putrajaya, the number of malnourished patients after surgery increased due to poor nutrition prior surgery. In addition, despited the malnutrition status of the patients,

additional nutritional was not given and no special nutrition was prescribed (Latiff et al., 2016). Hence, screening and giving appropriate nutrition recommendations are essential important even before surgery.

1.3 Significance of the study

The proposed study conducted for the purpose in determining the associations between socio-demographic factors, medical history, anthropometry measurements, biochemical data, dietary intake with PG-SGA among pre-operative surgical patients in Hospital Serdang, Selangor.

The variables stated above hopefully would fill the gap of knowledge to study the relationships between several factors that can affect malnutrition among surgical patients. Health practitioners have to keep up to date with the factors that associate the effect of surgical outcomes due to factors from various aspects such as socio-demographic factors, medical history, anthropometry measurements, biochemical data, and dietary intake with PG-SGA. By conducting this study, it enhances the knowledge of health practitioners especially to the doctors, nurses and dietitians that monitor nutritional status of the patients.

In addition, patients who are at nutritional risk can be detected early, hence further intervention can be done to encourage in providing steps to avoid malnourished patients before going to surgical procedures as well as in making sure patients are in the right condition.

Proper programs can be implemented when socio-demographic factors, medical history, anthropometry measurements, biochemical data and dietary intake are found to be associated with PG-SGA of pre-operative surgical patients. Hence, health practitioners and administrators can plan new strategies to take part in order to alter or to improve the nutritional risk of patients who are going to surgical procedures. Effective intervention program can be planned thoroughly to ensure patients are in optimum health and state before going to surgery

procedures. This can avoid severe complications after surgery and ensure better quality of life of the patients.

1.4 Objectives

General Objective

To determine the associations between socio-demographic factors, anthropometry measurement, biochemical data and dietary intake with PG-SGA score among pre-operative surgical patients in Hospital Serdang, Selangor.

1.5 Specific Objectives

1. To assess the status of malnutrition for pre-operative surgical patients in Hospital Serdang
2. To determine the socio-demographic factors, anthropometry measurement, medical history, biochemical data and dietary intake among pre-operative surgical patients in Hospital Serdang
3. To determine the association between socio-demographic factors, anthropometry measurement, medical history, biochemical data and dietary intake with malnutrition status among pre-operative surgical patients in Hospital Serdang.

1.6 Null Hypothesis

1. There is no association between socio-demographic factors (age, sex) and malnutrition status among pre-operative surgical patients in Hospital Serdang
2. There is no association between anthropometry data (BMI, skinfold triceps) with malnutrition status among pre-operative surgical patients in Hospital Serdang
3. There is no association between medical history with malnutrition status among pre-operative surgical patients in Hospital Serdang.
4. There is no association between biochemical data (serum albumin, lymphocytes count) with malnutrition status among pre-operative surgical patients in Hospital Serdang.
5. There is no association between energy and protein intake with malnutrition status among pre-operative surgical patients in Hospital Serdang.

1.7 Conceptual Framework

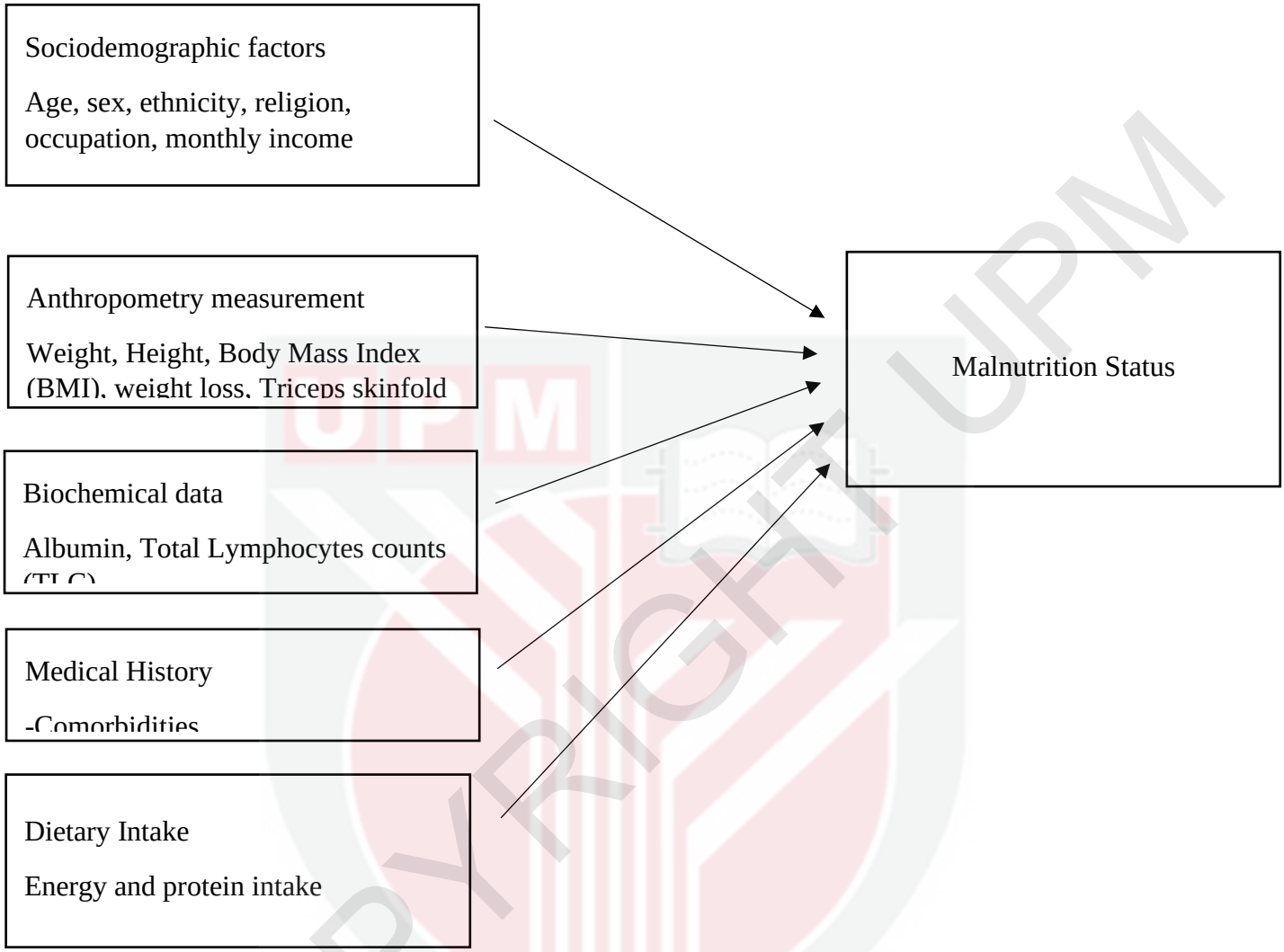

Figure 1: Conceptual Framework

CHAPTER 2

LITERATURE REVIEW

2.1 Status of malnutrition in surgical patients

Many studies have shown that there is high prevalence of disease-related malnutrition in both medical and surgical hospitalized patients. Malnutrition worsens the prognosis of the patients' conditions, thus there is association between malnutrition and higher in-hospital morbidity, increase the length of hospital stay and higher health care costs (Knappe-Drzikova, 2019). Malnutrition can be defined as an acute or chronic condition due to energetic imbalance, lack of energy, and other macronutrients in which may cause bad outcomes for body composition and clinical function. Therefore, there is high number of hospitalized patients of surgical patients due to poor nutritional status.

It is common for elective surgical patients who are admitted to hospital to experience malnutrition that associates with great postoperative morbidity. Up to 60% of surgical patients on admission are malnourished (Kahoekehr et al., 2010). According to Kahoekehr et al., (2010) 460 patients (310 acute, 150 elective) assessed using PG-SGA tool, 52% of acute patients were malnourished or at risk even with a BMI greater 25 kg/m^2 compared to 38% that presented electively. As a result, length of hospital stays increased significantly with worsening PG-SGA scores (Kahoekehr et al., 2010). Nutritional status was also assessed in 244 of gastrointestinal and orthopedics surgical patients, about 94 patients (39%) were mildly/borderline to severely malnourished (Bruun et al., 1999).

In patients who surgically treated for chronic mesenteric ischemia was found out to have prevalence of 70% out of 54 patients. This study concluded that preoperative malnutrition is the primary factor that decrease the survival rate of patients treated with open surgery. The

main indicator that were used to determine the malnutrition status is by using BMI, albumin and prealbumin serum (Allain et al., 2019).

Malnutrition was identified in patients undergoing continent urinary tract reconstruction which is about 20.8% (Strine et al., 2018). In a study of digestive surgery to evaluate preoperative refeeding in malnourished patients at risk of refeeding syndrome, it found that the overall postoperative morbidity rate was 88% (Loncar et al., 2019).

Status of malnutrition also was found in several types of cancer such as head and neck 48.9%, lymphoma 34%, lung 45.3%, colon/rectum 39.3%, esophagus and/or stomach 60.2%, pancreas 66.7%, breast 20.5%, ovaries/uterus 44.8% and prostate 13.9%. This study involved 1903 patients to assess the nutritional status in 154 French hospital wards (Hébuterne et al., 2014). In Korea, the prevalence of hospitalized patients of cancer patients who were malnourished is about 61%. Since the prevalence of malnutrition in hospitalized cancer patients are high and varied across tumour and stage, early identification of malnutrition status is needed to reduce the risk. (Wie et al., 2010). The prevalence of malnutrition among gastrointestinal cancer patients studied in a national hospital in Vietnam is 19% and after surgery about 26% out of 459 developed complications after surgery. Hence, preoperative malnutrition affects surgical outcomes of patients with gastrointestinal cancer in Vietnam (Loan et al., 2018). The prevalence of malnutrition in primary and revision arthroplasty patients was 16.9% (Kamath et al., 2016). In Malaysia, the prevalence of malnutrition among adult cancer being hospitalized approximately was 43.5% using SGA scores (Jamhuri et al., 2017). However another study conducted by Mohd et al., (2016) in elective surgery reported that before surgery, the patient's nutritional status was found to be majority well-nourished with 68% and 32% of suspected malnutrition.

Prevalence of malnutrition among cancer patients reduced from 31% in 2012 to 14% after receiving proper treatment and prevention strategies which improved patient outcomes (Marshall et al., 2019). To summarize, adequate intervention can improve nutritional status of cancer and surgical patients.

2.2 Factors associated with malnutrition

2.2.1 Socio demographic

One of the factors that may cause malnutrition for patients who are undergoing pre-operative surgery. Some of the characteristics can be included in this factor are age, gender, ethnicity and occupation. However, these characteristics are not fully associated with malnutrition.

A study about determinants of malnutrition and post-operative complications of 388 hospitalized surgical patients (Leandro-Merhi & de Aquino, 2014) Socio-demographic characteristics such as gender and age were taken into account. It is found that malnutrition was more common in males, which the individuals age 70 to 79 in the finding. However, age actually is more associated with malnutrition for this case. Individuals aged 70 years or more had twice increased risk of malnutrition (Leandro-Merhi, V. A., & de Aquino, 2014). In German, nutritional status was also assessed and it is found that malnutrition among hospitalized patients was 43% for patients who are 70 years and above compared to only 7.8% of patients below 30 years old (Pirlich et al., 2006). In Spain, the prevalence of oncology patients who are >70 years is nearly 40% who are at risk (Soeters et al., 2017). However, for the study of characteristics of the gender, a study conducted by Mignini et al., (2018) found that females were slightly more at malnourished risk than males; which is 48% vs 41%. In another study in thoracic surgery by Trufa et al., (2015) found that there is no significant different between males and females.

2.2.2 Medical History

Presence of comorbidities have to be taken into account because it has become a major concern among patients who require surgical procedures. In a study of laparoscopic total gastrectomy (LTG) which conducted in Korea, it was found that a total 189 patients had one or more comorbidities. Example of comorbidities that were presented in the study was hypertension which contributed the most number (37%), then followed by diabetes mellitus (17.8%), viral hepatitis, liver cirrhosis, pulmonary (27.1%), ischemic heart and stroke (2.3%). In addition to this study, the postoperative morbidity rate was 20.1% while mortality rate was 1.0% (Jeong et al., 2018).

2.2.3 Anthropometry measurements

Weight loss which >10% in 6 months has been proven to be a good indicator for nutritional assessment such as Subjective Global Assessment (SGA), Nutritional Risk Index (NRI), Mini Nutritional Assessment (MNA), Malnutrition Universal Screening Tool (Norman et al., 2008). A low BMI is also defined as independent predictor of higher rate of mortality in hospitalized elderly.

According to Soeters et al., (2017), low BMI does not always indicate malnutrition as patients who have high BMI may have decrease fat free mass in which it is due to nutrition deficit with combination of inflammation or infection. In oncology ward, hospitalized patients lost about 1 to 5kg during hospitalization and 8.8% lost 5kg or more (Soeters et al., 2017). According to SGA taken from the patients, it can be reflected by lower BMI with higher percentage of patients with unintentional weight loss as well as low muscle mass (Pirlich et al., 2006). In the elective surgical patients' group, 29.6% which BMI that is higher than 25kg/m^2 were risk at malnourished (Kahoekehr et al, 2010). BMI is the first step to screen patients who undergo malnutrition before further assessments and interventions will be done. A study of hospitalized patients which include patients from medicine, surgical and intensive care unit

wards were assessed for Malnutrition Universal Screening Tool (MUST), it is found that 7% of patients had less than 18.5 of BMI (Rahman et al., 2015).

In a prospective cross-sectional study in Spain, mean BMI was 25.7kg/m^2, 6.2% of patients had BMI less than 18.5 while overweight is 33.7% and 15.7% obesity. It was calculated that that mean percentage of weight loss from regular weight loss was 4.8 ± 5.8, had longer hospital stay and 51% of these patients were admitted in the previous 12 hours. In this study, the mean weight loss of malnourished patients was 4.9kg compared with those well-nourished, 0.7kg.

2.2.4 Biochemical data

Albumin and lymphocytes have been used widely to assess the nutritional status of an individual. Level of albumin is a significant indicator to assess malnutrition status of hospitalized patients. Albumin that is less than 3.5 g/dl will be recognized as malnourished (Adogwa et al., 2016). A study was conducted in pre-operative gastro surgical patients (n-69), it was found that the prevalence of malnutrition according to albumin level was 40.6% and 73.9% through TLC (Norte et al., 2015).

Low total lymphocyte is one of the method to measure malnutrition status in which TLC that <1200 cell/mm^3 is related to malnutrition while <900 cell/mm^3 is related to severe malnutrition (Gunarsa et al., 2011). In a study to predict the prevalence of malnutrition using total lymphocytes count as nutritional parameter, among 69 patients, 51 of them (73.9%) was found to be affected by TLC (Norte et al., 2015). However, BMI was the main confounding factor for this study (Norte et al., 2015). Chiarelli et al., (2019) reported that preoperative lymphocytopenia and rectal resection were independently associated with high morbidity rate. However, this study was affected by several factors such as age, sex, urgent surgery and malignant tumor. The prevalence of malnutrition associated with TLC among hospitalized

patients that was conducted in Jakarta, Indonesia, however was found to have 52% malnourished patients in which 33% patients with TLC <1200 cell/mm^3, 57% patients with malnutrition and TLC <1200 cell/mm^3 (p=0.001) (Gunarsa et al., 2011).

2.2.5 Dietary intake

Preoperative food intake is reported to have high correlation with wound healing response than absolute losses of protein and fat from body stores in which can also be a risk factor to develop pressure ulcers among hospitalized patients (Norman et al., 2008). According to ESPEN guideline: Clinical Nutrition in Surgery, the energy and protein requirements can be estimated with 25-30 kcal/kg and 1.5 g/kg respectively using ideal body weight (Weimann et al., 2017).

In a study on dietary intake and nutritional status among pancreatic cancer surgical patients, it is found that 45.1% who were malnourished prior to admission increased to 87% after surgical procedures. In this study, daily intake of patients was recorded and was found out that most patients experienced two or more symptoms such as anorexia, abdominal bloating and early satiety.

In a study conducted to determine the malnutrition status energy intake and protein intake using PG-SGA, it was found out that out of 70 pre-operative colorectal surgery patients 37% of them were malnourished. Based on the PG-SGA data taken, patients who scored B or C took ~40% less energy and protein compared with well-nourished patients (Gillis et al., 2015). Based on the study, there were several reasons why patients had difficulty to achieve dietary requirements such as missed meals, loss of appetite and feeling tired or anxious. Not getting food wanted, disruption during meals by noises and smells were the common barriers during food intake. 23% of the malnourished patients were readmitted within 30 days (Gillis et al., 2015).

CHAPTER 3

METHODOLOGY

3.1 Study design

This was a cross-sectional study that aimed to determine the association between socio-demographic factors, anthropometry measurements, biochemical data and dietary intake with PG-SGA among pre-operative surgical patients in Hospital Serdang, Selangor.

3.2 Study location

This study was conducted in Hospital Serdang. Hospital Serdang is located in the district of Sepang which is also near o Putrajaya. It is a government-funded multi-specialty hospital which provides various facilities, specific specialization in various diseases. It was launched in 2006 which estimated to have around 620 beds, 34 department and unit. In addition, Hospital Serdang has been the center teaching hospitals for medical and health sciences students of Universiti Putra Malaysia (UPM). Hospital Serdang is responsible as a center of Cardiology and Cardiothoracic Malaysia.

3.3 Subjects

The participants of this study were the pre-operative patients in surgical department in outpatients, in patients in ward 6B and ward 6C in Hospital Serdang. The participants were pre-operative surgical patients specially those who are in elective surgery. This is because most surgical procedures in this hospital is general. Pre-operative patients who meet the criteria were requited in the study. The inclusion and exclusion criteria were tabulated in Table 3.1.

Table 1: Subject's selection criteria

Inclusion Criteria	Exclusion criteria
• Men and women above 18-70 years old • Those who is going for surgery treatment • Malaysians and able to communicate Malay or English language	• Those who are handicapped, comatose state, disability to hear and talk • Diagnosed with mental illnesses and cognitive impairment • Critically ill patients

3.4 Sample size determination

Correlation Sample Size Formula

$$N = [(Z\alpha+Z\beta)^2 / [(r^2 / 1- (r)^2)] + 5$$

(Cole et al, 1997)

Where,

$Z\alpha = 1.96$

$Z\beta = 0.84$

r = the expected correlation coefficient

Correlation studies	Correlation, r*	Sample size, s
Weight loss in one month with PG-SGA among cancer patients in Thai settings.	0.66	$N = [(1.96+0.84)^2 / [(0.66^2 / 1- (0.66)^2)] + 5$ = 15

(Nitichai et al., 2019)		
Weight loss in 6 months with PG-SGA among patients with cancer (Isenring et al., 2003)	0.31	$N = [(1.96+0.84)^2 / [(0.31^2 / 1- (0.31)^2)] + 5$ =78
Quality of Diet with PG-SGA (Lim & Choue, 2010)	- 0.832	$N = [(1.96+0.84)^2 / [(-0.832^2 / 1- (-0.832)^2)] + 5$ = 8

Estimated attrition rate = 10% x 78 = 7.8

N = 85

By comparing the sample size from other correlation studies, the highest sample size came from the study from (Isenring et al., 2003) regarding the correlation between weight loss in 6 months with PG-SGA in hospitalized patients which is 78. By considering the estimated attrition rate, the most appropriate sample size of this study is 85. However, the research had to stop due to pandemic of COVID-19 that occurred during data collection. Due to time constraint and limited number of patients that agreed to be interviewed, the number of overall patients for this study was only 39.

3.5 Sampling design

From the total of 19 wards in Hospital Serdang, surgical outpatient department, 6B ward and 6C ward were selected through purposive sampling. Next, by using convenience sampling, all pre-operative surgical patients that fit into inclusion criteria were interviewed and collect the data for this study.

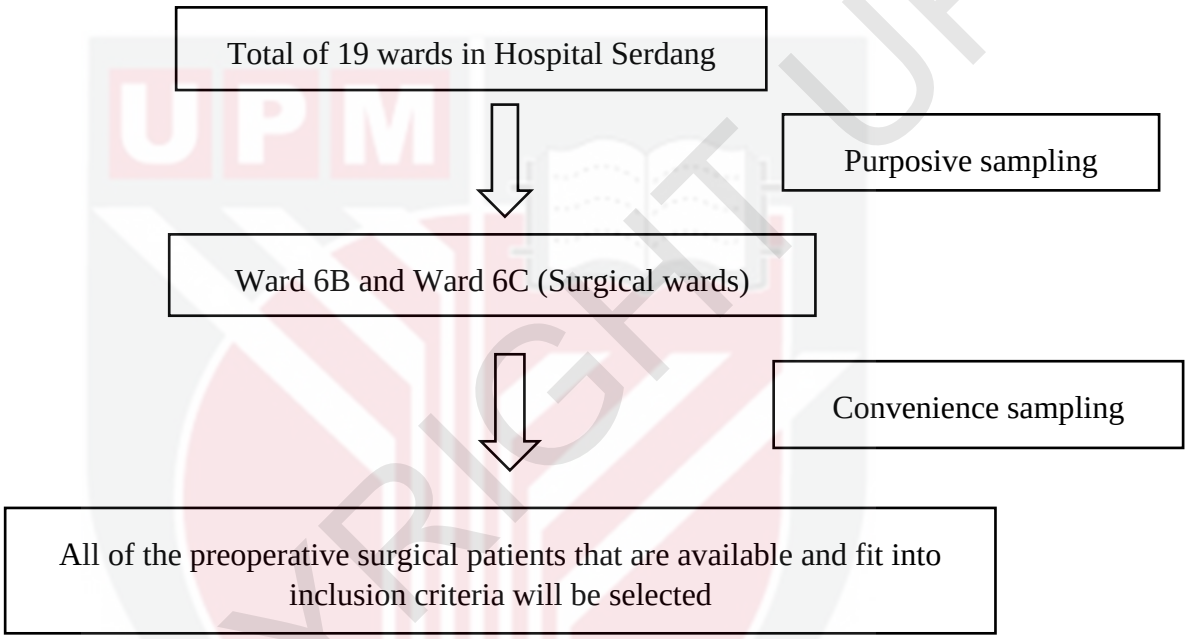

Figure 2: Sampling design

3.6 Measures

3.6.1 Socio-demographic information

Self-administered interviewed questionnaires were developed in order to be used to collect socio-demographic information. The information filled are either open-ended or multiple choices answer. The questionnaires of this section include age, sex, ethnicity, religion, occupation, education level and monthly income of the subjects. 3.6.2 Anthropometry measurements

i. Weight and height

All of the anthropometry measurements that were performed to the subjects were being referred in Anthropometry Procedures Manual published by Center of Disease Control and Prevention (2007). Body weight was measured using a TANITA Digital Weight Scale HD306 (TANITA Corporation, USA) to the nearest 0.1kg meanwhile, height was assessed using a SECA Portable Stadiometer (SECA 213, Germany) to the nearest 0.1cm. These anthropometric measurements were taken thrice and for each measurement, the mean value was determined and analyzed.

Body Mass Index (BMI) was identified by using body weight and height obtained from the previous measurements. BMI was calculated using the formula of = weight (kg) / height $(m)^2$. The BMI classification were being referred using WHO (2002) cut off points which were grouped as “underweight”, “normal”, “overweight” and “obese”.

For weight loss, the formula as follow:

Percentage weight loss = (usual weight – actual weight) x 100 / usual weight (Daniel E Shumer Norman P Spack, 2017)

Table 2: Classification of malnutrition in the context of acute illness by ADA/ASPEN (2012)

Time	Moderate malnutrition	Severe Malnutrition
1 week	1-2%	>2%
1 month	5%	>5%
3 month	7.5%	>7.5%
6 month	10%	>10%

3.6.3 Biochemical data

Biochemical data of the patient which is albumin and lymphocytes were taken from medical record of the patients. Table 3.4 and Table 3.5 show the classification of albumin levels and lymphocytes respectively

Table 3. Classification of albumin by (Norte et al., 2015)

	Nourished	**Mild malnourished**	**Moderately malnourished**	**Severely malnourished**
Albumin level, g/dl	>3.5	3.0-3.5	2.4-2.9	<2.4

Table 4. Classification of lymphocytes counts by (Collins, 2003)

> 2000 cells	Normal
1200 to 2000	Mild depletion
800 to 1199	Moderate depletion
<800	Severe depletion

3.6.4 Medical history

Medical history of the subjects is significant in order to study prevalence of co-morbidities present of patients who undergoing surgical procedures. The data obtained from medical history presented in descriptive data. The interviewer-administered questionnaires or medical record were used in order to obtain information during data collection. The questionnaires include the length of stay, co-morbidities and causes of undergoing surgery.

3.6.5 Dietary Intake

A 24-hour dietary recall was conducted on the day of the data collection by the researcher. Researcher conducted an interview and patients were required to report their previously 24-hour diet recall. The data obtained was analyzed in Nutritionist PRO software. The total energy and protein intake for the patient were recorded. The information retrieved from the software is mainly the calorie intake in kcal and protein in gram.

3.6.6 PG-SGA score

The classification of malnutrition was assessed using PG-SGA. Using PG-SGA as the gold standard to measure hospitalized patients especially cancer patients, has the ability to predict clinical outcomes such as survival, postoperative complication and tolerance towards chemotherapy (Balstad et al., 2019). In addition, validity of this instrument has been done in many studies due to its sensitivity and better specificity to measure malnutrition status and prioritize necessary intervention (Balstad et al., 2019 ; Nitichai et al., 2019). PG-SGA consisted 4 sections which covered patient medical history, food intake, functional status, metabolic demand and physical examination. The total score of the assessment was categorized based on scores obtained. The triage scores as follow; Stage A: well nourished; Stage B: Moderate or suspected malnutrition and Stage C: Severely malnourished.

3.7 Pre-testing

Prior to the study, pre-testing was conducted at Hospital Serdang, Selangor. About 10 preoperative surgical patients who fulfilled the inclusion criteria participated. They were also excluded from the real data collection. The purpose of pre-testing was to determine whether the questionnaires was applicable to patients. The clarity and readability of the questionnaires as well as its structures were analysed during this procedure. The participants were requested to give comments if there were any to improved. All of the questionnaires feedback were taken into account and reviewed thoroughly. This pre-testing was to estimate time taken during data collection.

3.8 Data collection

Data collection was performed from January to March 2020. Patients who were available in outpatient clinics, ward 6B and ward 6C that fit into inclusion criteria were recruited in this study. Information sheet and consent form were given before answering the

questionnaires. Most questionnaires were either face-to-face interview, self-administered. The questionnaires composed of four section. Firstly, the first section, section A was filled by the patient which is socio-demographic information. The second section was the anthropometric measurements and the third was medical history. For anthropometric measurements, the specific measurement tools were used. Next section is biochemical data which mostly obtained in medical record while dietary intake of the patients using 24-hour diet recall was obtained during interview session. Lastly, the researcher performed PG-SGA to the patients before ending the session. All data obtained were computed in SPSS software.

3.9 Ethics approval

Ethical approval for the study was obtained from Medical Research Ethics Committee (MREC) with the permission from director of Hospital Serdang prior to data collection. Information sheet and consent form were distributed to the patients to inform them regarding the purpose of this study (NMRR-18-262543546 ('IR))

3.10 Statistical Analysis

All the statistical analysis was conducted by using IBM SPSS Statistics 22, with statistical significance level set at $p<0.05$. The univariate analysis was used to analyze descriptive data. For univariate analysis, the results for categorical variables were presented as frequencies and percentages while the results for categorical variables were presented as frequencies and percentages while the result for continuous variables were presented as means and standard deviation. The bivariate analysis was used to analyze the inferential data. In bivariate analysis, the chi-square test was used to measure the significant associations between two categorical variables.

CHAPTER 4

RESULTS AND DISCUSSIONS

This chapter presented the findings of this study in which to determine the associations between sociodemographic factors, medical history, nutritional status (anthropometry measurements, biochemical data, and dietary intake) and malnutrition status among pre-operative surgical patients in Hospital Serdang, Selangor.

4.1 Sociodemographic characteristics of pre-operative surgical patients in Hospital Serdang, Selangor.

There were 39 pre-operative surgical patients participated in this study. Their mean age was 46.03 ± 16.77 years in which 12 (30.8%) males and 27 (69.2%) of the patients were (10.3%). In terms of educational level, more than half of the patients received up to secondary education, 9 patients received up to tertiary education and 8 patients received until primary education. From this study, it was found that majority of the patients' monthly income were quite low for each individual, which 50% of them had income below than RM500. This is probably most of the participants were females and they depend on their spouses for the source of living income. For marital status, 31 out of 39 patients were married and the rest of them were either single or others. In terms of the occupation, about a quarter of the participants (26.3%) were unemployed, meanwhile majority of them were employees (36.8%). Moreover, in this study it was found that only one out of 39 patients were a student, followed by 5 were self-employed and 8 were retired. The sociodemographic characteristics of all pre-operative surgical patients in Hospital Serdang are tabulated in Table 4.1.

Table 5: Sociodemographic characteristic of pre-operative surgical patients in Hospital Serdang (n=39)

Variables	n	%	Mean ± SD
Sex			
Male	12	30.8	
Female	27	69.2	
Age			46.03 ± 16.77
18-49	20	52.6	
50-60	8	21.1	
60-70	10	26.3	
Ethnicity			
Malay	28	71.8	
Chinese	4	10.3	
Indian	7	17.9	
Educational Level			
Primary education	8	20.5	
Secondary education	22	56.4	
Tertiary education	9	23.1	
Income per month			
RM 0 – RM 500	19	50.0	
RM 501 – RM 1000	4	10.5	
RM 1001 – RM 2000	10	26.3	
RM 2001 – RM 3000	1	2.6	
>RM 3000	6	10.5	
Occupation			
Student	1	2.6	
Employee	14	36.8	
Self- employed	5	13.2	
Retired	8	21.1	
Unemployed	10	26.3	

Marital Status		
Single	4	10.3
Married	31	79.5
Others	4	10.3
Current Living Status		
None	1	2.6
Own Family	36	92.3
Parents	2	5.1

4.2 Anthropometry measurements of pre-operative surgical patients according to sex in Hospital Serdang

The overall mean for weight admission of the patients was 67.44 ± 16.13 kg while comparing with mean of usual weight of the patients was 68.58 ± 16.27 kg. It can be seen that there was a slightly weight loss upon admission. There was a significant difference of comparison between male and female in terms of their mean usual weight, 73.13 ± 16.15 kg and 66.64 ±16.15 kg respectively. However, the usual weight was only reported by the patients and some inaccuracy due to under or overreporting might occur. Total weight loss in a month was found among 7 of the overall participants with total mean of 3.13 ± 4.97%. However, majority of the patients had lesser than 5% of weight loss in a month. It was found that male had greater weight loss compared to female (3.13 ± 6.67% and 2.85 ± 4.16% respectively) with brings the total mean of 3.13 ± 4.97%.

The mean BMI of the patients were 26.81 ± 5.71 kg/m2 which indicates that the average BMI for these patients were overweight according to World Health Organization. Relatively, both males and females had about similar mean of BMI which are 26.52 ± 5.55 kg/m^2 and 26.93 ± 5.87 kg/m^2 respectively. In terms of detailed nutritional features of the BMI classification, it was found that 36.8% were overweight and 34.2% of the were categorized as normal. Meanwhile, for the classification of obesity 8 patients were found to be obese and only 3 of the patients were underweight. Table 4.2.1 shows the anthropometry measurements according to sex and table 4.2.2 shows results of classification for BMI and weight loss <5% in a month of pre-operative surgical patients.

Table 6: Anthropometry measurements of pre-operative surgical patients according to sex in Hospital Serdang (n=39)

Characteristics	Male	Female	Total
	mean ± SD	Mean ± SD	Mean ±SD
Weight admission, kg	71.01 ± 15.84	65.86 ± 16.30	67.44 ± 16.13
Usual weight, kg	73.13 ± 16.15	66.64 ±16.15	68.58 ± 16.27
Weight loss, %	3.13 ± 6.67	2.85 ± 4.16	3.13 ± 4.97
BMI, kg/m^2	26.52 ± 5.55	26.93 ± 5.87	26.81 ± 5.71

Nutritional Features	n (%)	Mean ± SD
BMI, kg/m^2		26.81 ± 5.71
Underweight	3 (7.9)	
Normal	13 (34.2)	
Overweight	14 (36.8)	
Obese	8 (21.1)	
Weight loss, %		
≤ 5 %	30 (76.9)	
≥ 5 %	7 (17.9)	

4.3 Biochemical data of pre-operative surgical patients in Hospital Serdang, Selangor

Albumin and total lymphocytes counts are examples to indicate malnutrition. The biochemical data of albumin and lymphocytes were presented in Table 4.3.1. Averagely, the overall mean albumin level is 2.80 ± 1.07 which this number falls into severely malnourished

level. Males had greater level of albumin level (3.20 ± 1.11) compared to females which was found to be lesser (2.62 ± 1.04). Total mean of total lymphocytes counts of the patients were 2217.85 ± 524.07 which found to be mild depleted with male had relatively lower number of total lymphocytes compared to females (1854.67 ± 574.80 and 2379.26 ± 416.772 respectively).

Table 7: Biochemical data based on sex of pre-operative surgical patients in Hospital Serdang (n=39)

Characteristics	Male	Female	Total
	Mean ± SD	Mean ± SD	Mean ± SD
Albumin, g/L	3.20 ± 1.11	2.62 ± 1.04	2.80 ± 1.07
Lymphocytes, cell/m^3	1854.67 ± 574.80	2379.26 ± 416.772	2217.85 ± 524.07

Table 4.3.2 shows the classification of albumin level and total lymphocytes counts of the patients. 48.7% of the total patients showed to be classified as severely malnourished for their albumin level and 38.5% were found to be nourished while the rest were moderate to mildly malnourished (2.6 % and 10.3 respectively). In terms of total lymphocytes counts, majority (64.1%) of the patients were found to classified as normal. None was found to have severe depletion number of total lymphocytes counts.

Table 8: Classification of albumin and lymphocytes level of pre-operative surgical patients in Hospital Serdang (n=39)

Nutritional Features	n (%)
Albumin, g/L	
Severely malnourished	19 (48.7)
Moderately malnourished	1 (2.6)
Mild malnourished	4 (10.3)
Nourished	15 (38.5)
Total Lymphocytes Count, cells/m^3	
Severe depletion	0 (0)
Moderate depletion	2 (5.1)
Mild depletion	12 (30.8)
Normal	25 (64.1)

4.4 Medical History of Pre-Operative Surgical Patients in Hospital Serdang

Table 4.4 shows the distributions of comorbidities presented by pre-operative surgical patients. Hypertension seems to be common comorbidity in these patients which contributed the most numbers (28.2%) among other comorbidities. Relatively comorbidities such as diabetes, cancer and hyperlipidemia shared the same number of comorbidities which is (10.3%). Cardiovascular shows the least number which contributed only 7.7%. Other comorbidities such as gout, pulmonary, renal, sepsis, anemia contributed 20.5%.

Table 9: Types of Comorbidities presented in pre-operative surgical patients in Hospital Serdang (n=39)

Comorbidities	n	(%)
Diabetes	4	10.3
Hypertension	11	28.2
Cardiovascular diseases	3	7.7
Cancer	4	10.3
Hyperlipidemia	4	10.3
Others	8	20.5

4.5 Diet History of Pre-operative Surgical Patients in Hospital Serdang

The overall energy intake of pre-operative surgical patients was 1304 ± 566. Males showed to have greater energy intake compared to females (1503 ± 588 and 1216 ± 544 respectively). It was also found that protein intake among males (61 ± 24) were higher compared to females (46 ± 34). The main source of energy come from complementary feeding they had before admission and during their stay in the ward before proceed with the surgical procedures. Among 38 patients that were interviewed, only 1 patient who was in tube feeding regimen. Both energy and protein intake among pre-operative surgical patients were relatively low as they needed more energy and protein requirements for better recovery. However, it is common for pre-operative setting patients to have low intake due to conventional feeding strategy practice which is a long-due fasting to reduce surgical trauma (Yi et al., 2020) although proper monitoring of nutrient intake should be considered even before going to surgery to avoid unnecessary depletion of muscle and fat mass due to anabolism process. Table 4.5 shows the energy and protein intake of pre-operative surgical patients in Hospital Serdang.

Table 10: Energy and protein intake of pre-operative surgical patients in Hospital Serdang (n=39)

Characteristics	Male	Female	Total
	Mean ± SD	Mean ± SD	Mean ± SD
Energy Intake, kcal	1503 ± 588	1216 ± 544	1304 ± 566
Protein intake, g	61 ± 24	46 ± 34	51 ± 32

4.6 Malnutrition Status of Pre-operative Surgical Patients in Hospital Serdang

Malnutrition status by PG-SGA shows that majority (74.4%) of pre-operative surgical patients to be rated as grade A for the PG-SGA category rating while only 20.5% of these patients to either to be mild/severe malnourished ranked as B and C respectively. Both patients rank B and C were classified as malnourished for the simplicity. Generally, PG-SGA nutritional assessment has two scores which are either grading score or total numerical score. When comparing total numerical score, the prevalence of malnourished patients increased slightly higher (38.5%) than PG-SGA grading score. According to finding Ræder et al., (2018), PG-SGA numerical score increased the sensitivity compared to PG-SGA grading score from minor contribution from detailed physical examination. This finding was found to be consistent with a study conducted by Mohd et al., (2016) that majority of elective surgery patients were found to be well-nourished as well. In this study, the researcher chose to use grading score to evaluate and associate factors that contributed to malnutrition status of the patients for simplicity. Table 4.6.1 and table 4.6.2 show the distributions of nutritional status of pre-operative surgical patients based on grading scores and numerical scores respectively.

Table 11. PG-SGA grading scores based on sex of pre-operative surgical patients in Hospital Serdang (n=39)

Sex	PG-SGA category rating n (%)	
	A (nourished)	B & C (malnourished)
Male	8 (20.5)	4 (7.7)
Female	21 (53.8)	6 (12.8)
Total	29 (74.4)	10 (20.5)

Table 12. PG-SGA numerical scores based on sex of pre-operative surgical patients in Hospital Serdang (n=39)

Sex	PG-SGA numeric score	n (%)
Male	1-3	9 (23.1)
	≥ 4	3 (7.7)
Female	1-3	15 (38.5)
	≥ 4	12 (30.8)
Total	1-3	24 (61.5)
	≥ 4	15 (38.5)

4.7 Hypothesis testing

4.7.1 Association between socio-demographic (age and sex) with malnutrition status among pre-operative surgical patients in Hospital Serdang

In terms of the associations between sociodemographic and malnutrition status of pre-operative surgical patients using PG-SGA, there was a significant association between age and malnutrition status (r=0.517, p=0.001**). This means that there are positive correlation and association between these two variables. However, there was no significant associations between sex and malnutrition status. Based on the result showed in table 4.7.1 there are positive

correlation between age and malnutrition status measured using PG-SGA which indicates the higher the age, the higher the malnutrition status of pre-surgical patients using PG-SGA tools. This finding was also similar with previous studies in which older individuals were more associated with high risk of malnutrition (Leandro-Merhi & de Aquino, 2014; Soeters et al., 2017). According to the justifications, older age are prone to get malnourished due to longer stay in hospital and are at risk of complications (Leandro-Merhi & de Aquino, 2014). Therefore, the null hypothesis was rejected.

Table 13. Association between socio-demographic (age and sex) with malnutrition status among pre-operative surgical patients in Hospital Serdang (n=39)

Variables	**Malnutrition n (%)**		***r***	***X²***	**p-value**
	Well-nourished	**Malnourished**			
Age[b]			0.517		0.001*
Sex[a]				0.538	0.463
Female	21 (53.8)	6 (15.4)			
Male	8 (20.5)	4 (10.3)			

[a]Chi-square test [b]Pearson's correlation *Significant association p<0.05

4.7.2 Association between anthropometry measurement (BMI) and malnutrition status of pre-operative surgical patients of Hospital Serdang

There was no significant association between anthropometry measurement and malnutrition status of pre-operative surgical patients using PG-SGA tools. When categorized the BMI classifications with their nutritional status, it was found that there were a greater number of well-nourished patients who are normal, overweight and obese. Only when comparing with patients who are classified under underweight, there were slightly increase number of patients who were malnourished than well-nourished. Based on the results showed in table 4.7.2 there were no associations between BMI and weight with malnutrition status of

the pre-operative surgical patients (p>0.005). Thus, null hypothesis was rejected. This finding was found to be inconsistent with previous studies that associated BMI with poor malnutrition status Pirlich et al., (2006). BMI is not the most significant tools to measure malnutrition status especially elderly in the study. According to Gavriilidou et al., (2015), limitation in BMI also related to alteration of age in body composition, hence other anthropometric should take into account such as waist circumference or triceps skinfold.

Table 14. Association between anthropometry measurement (BMI) and malnutrition status of pre-operative surgical patients of Hospital Serdang

Variables	**Malnutrition**		***r***	***X^2***	***p***
	N (%)				
	Well-nourished	**Malnourished**			
BMI[a]			-0.163		0.328
Weight loss in 3-6 months[b]				1.079	0.295
<5%	23 (58.9)	7 (17.9)			
>5%	4 (10.3)	3 (7.7)			

Pearson's correlation test[a] Chi-square test[b] *Significant association p<0.05

4.7.3 Associations between biochemical data (albumin and total lymphocytes counts) and PG-SGA grading score of pre-operative patients in Hospital Serdang

There was a significant association between biochemical data and malnutrition status of pre-operative surgical patients using PG-SGA tool only between number of total lymphocyte counts (p=0.045). Hence, the null hypothesis was rejected. This study had similar significant finding in previous studies in hospitalized patients in Jakarta (Gunarsa et al., 2011). There was no significant association between albumin and malnutrition status of pre-operative surgical

patients. This can indicate other reason as well such which not related to nutrition indicator such as presence of underlying diseases (Scheunemann et al., 2011) or inflammation.

Table 15. Associations between biochemical data (albumin and total lymphocytes counts) and malnutrition status of pre-operative patients in Hospital Serdang

Variables	Malnutrition status (PG-SGA)	
	r	p-value
Albumin, g/dL	0.191	0.245
Total lymphocyte counts, cells/m^3	-0.296	0.068

Pearson's correlation test *Significant association $p<0.05$

4.7.4. Associations between medical history (comorbidities presented) and malnutrition status of pre-operative surgical patients in Hospital Serdang, Selangor

There were significant associations between medical history and malnutrition status using PG-SGA tools. In terms of medical history, number of comorbidities are highly associated with malnutrition status of these patients ($p=0.004$). From the distributions in table 4.7.4a number of patients who had more than one comorbidity were more malnourished compared to well-nourished. This finding is similar with Maurer et al., (2020) in which patients who have more comorbidities were more vulnerable getting malnourished. These patients could get malnourished from the medications intake, less movements and lower food intake from the comorbidities they experienced even before going to surgery (Maurer et al., 2020). Hence, null hypothesis was rejected.

Table 16. Associations between number comorbidities presented and PG-SGA grading score of pre-operative surgical patients in Hospital Serdang (n=39)

Variables	Malnutrition		X^2	p
	N			
	Well-nourished	Malnourished		
Number of comorbidities presented[a]			8.327	0.004**
≤ 1 comorbidity	25 (64.1)	4 (10.3)		
≥ 1 comorbidity	4 (10.3)	6 (15.4)		

[a]Chi-square test *Significant association p<0.05

4.7.5 Associations between dietary intake (energy intake and protein intake) and malnutrition status of pre-operative surgical patients in Hospital Serdang, Selangor

There was an association between dietary intake and malnutrition status among pre-operative surgical patients. From table 4.7.5 both energy intake and protein intake were highly associated and negatively correlated with malnutrition status using PG-SGA tools (r=-0.531, p=0.001**; r=-0.371, p=0.019**). This indicates that the lesser the energy and protein intake, the higher the malnutrition status. The finding shows the similar result as previous studies conducted by Gillis et al., (2015). The dietary intake is associated with malnutrition status because the nutrients in patient's bodies may be deteriorated because the energy and protein are needed to promote catabolism (Yi et al., 2020). Hence, null hypothesis was rejected.

Table 17. Associations between dietary intake (energy intake and protein intake) and malnutrition status of pre-operative surgical patients in Hospital Serdang, Selangor (n=39)

Intake	Malnutrition status (PG-SGA)	
	r	p-value
Energy intake (kcal)	-0.531	0.001**
Protein intake (g)	-0.371	0.019**

Pearson's correlation test *Significant association $p<0.05$

CHAPTER 5

CONCLUSION, STRENGTHS, LIMITATIONS AND RECOMMENDATIONS

5.1 Conclusion

This study found that the prevalence of malnutrition among pre-operative surgical patients were only 20.5% while majority number of patients were 74.4% when using PG-SGA grading scores. However, the prevalence of malnutrition slightly increased using PG-SGA numerical category score in which 38.5% were categorized as malnourished and 61.5% were well nourished. Among all factors studied, age, total lymphocyte counts, number of comorbidities, energy and protein take were found to have statistically significant association with malnutrition status of pre-operative surgical patients.

Although in this research number of malnourished were not significantly high, proper monitoring of patients who are at risk of malnutrition should be done by healthcare professionals especially the dietitians as well as nurses and doctors. Malnutrition need to be identified early and proper intervention should be implemented which in turn will present poor outcomes in post-operative complication and hence, provide better quality of life for these patients.

5.2 Strengths

This study provides several strengths that made the findings valuable. First, the medium of interview used was face-to-face interview which help to reduce the data inaccuracy and decrease the possibility of bias compared to self-report method. The researchers were trained on how to prevent under-reporting or over-reporting by using examples and photos to report 24-hour diet recall. Next, this study hopefully has provided the better understandings on factors associated with malnutrition among pre-operative patients especially in elective surgical setting to tackle the malnutrition issue before going to surgical treatment.

5.3 Limitations and Recommendations

Several limitations of this study have been ruled out in order to provide better research guideline for the future. First and foremost, the number of patients scheduled for elective surgical treatments are limited every week with the pandemic COVID-19 issue that suddenly arose. However, the results showed were a good baseline for further studies to improve. Next, this cross-sectional study also provides limited causal relationships between associated factors with malnutrition status, hence the findings were not conclusive. In addition, the study was only conducted in Hospital Serdang which is the only single-centred study. Hence, some recommendations should be done in order to improve the exact problems that contribute to prevalence of malnutrition. More issues regarding this research study should be expanded in terms of number of participants selected as well as conducting the study in multi-centred places to obtain more significant findings.

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APPENDICES

APPENDIX A

MREC APPROVAL LETTER

JAWATANKUASA ETIKA & PENYELIDIKAN PERUBATAN

(Medical Research & Ethics Committee) KEMENTERIAN KESIHATAN MALAYSIA dla Kompleks Institut Kesihatan Negara Blok A, No 1, Jalan Setia Murni U13/52,

Seksyen U13, Bandar Setia Alam,

40170 Shah Alam, Selangor. •re': 03-3362 8888/8100/8205

Ref:(12)KKM/NIHSEC/ P18-1985

Date: 20-March-2019

Dr Zalina Abu Zaid UNIVERSITY PUTRA MALAYSIA WPM)

Dear Sir/ Mdm,

ETHICS INITIAL APPROVAL:

NMRR-18-262543546 ('IR)

RESUBMISSION : Effectiveness of intensive perioperative nutrition therapy among adults undergoing surgery (NMRR-18459-40279)

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 wili 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 the Biological Resources and Benefit Sharing Act 2017.

3. The investigators involved in this study are:

HOSPITAL SERDANG

Dr Zalina Abu Zaid (Principal Investigator)

Associate Prof. Dr Mohd Faisal Bin Jabar Dr Barakatun Nisak Mohd Yusof

Dr Nyanamalar A/P Krishnan

Ms A'shah Zafirah binti Abdul Azim

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 Proposal Version 1, dated 1 1 March 2019

2. Patient Information sheet & Informed Consent Form (English) Version 2, dated 1 1 March 2019
3. Patient Information sheet & Informed Consent Form (BM) Version 3, dated 11 March 2019
4. Questionnaire Version 4, dated 15 August 2018
5. Investigator's documents: IAHOD, CV, GCP certificate and COI declaration :

Ref:(12)KKM/NIHSEC/PI 8-1985

HOSPITAL SERDANG

Dr Zalina Abu Zaid (Principal Investigator)

Associate Prof. Dr Mohd Faisal Bin Jabar Dr Barakatun Nisak Mohd Yusof

Dr Nyanamalar A/P Krishnan

Ms A'shah Zafirah binti Abdul Azim

5. Please note that the approval is valid unti 19-March-2020.The following are to be reported upon receiving ethical approval. Required forms can be obtained from the Medical Research Ethics Committee (MREC) website (http://www.nih.qov.my/mrec).

i. Continuing Review Form has to be submitted to MREC within 2 months (60 days) prior to the expiry of ethical approval.

ii. Study Final Report upon study completion to the MREC.

iii. Ethical approval is required in the case of amendments/ changes to the study documents/ study sites/ study team. MREC reserves the right to withdraw ethical approval if changes to study documents are not completely declared.

iv. Applicable for Clinical interventional Studies only: Report occurrences of all Serious Adverse Events (SAEs), Suspected Unexpected Serious Adverse Reaction (SUSARs) and Protocol DeviationNioIation at all MREC approved sites to MREC. SAEs are to be reported within 15 calendar days from awareness of event by investigator. Initial report of SUSARs are to be reported as soon as possible but not later than 7 calendar days from awareness of event by investigator, followed by a complete report within 8 additional calendar

6. A total of 70 subjects/ patients/ respondents are targeted to enroll this study in Malaysia.

7. Please take note that the reference number for this letter must be stated in all correspondence related to this study to facilitate the process.

Comments (if any): Nil

Project Sites:

HOSPITAL SERDANG

APPENDIX B

HOSPITAL SERDANG APPROVAL LETTER

PUSAT PENYELIDIKAN KLINIKAL
(CLINICAL RESEARCH CENTRE)
ARAS 2 HOSPITAL SERDANG
JALAN PUCHONG
43000 KAJANG
SELANGOR DARUL EHSAN

CRC
MINISTRY OF HEALTH MALAYSIA
Research that matters to patients

Telefon : 03-89475467
Fax : 03-89475467

Rui kami : HSDG/P/CRC/710/11/9(466)
Tarikh : 14hb Jun. 2019

Tuan,

KELULUSAN MENJALANKAN PENYELIDIKAN DI HOSPITAL SERDANG

Dengan segala hormatnya merujuk kepada perkara di atas,

2. Sukacita dimaklumkan bahawa Jawatankuasa Pusat Penyelidikan Klinikal (CRC) Hospital Serdang telah meluluskan permohonan penyelidikan tuan seperti yang berikut :

Penyelidik: **Dr Zalina Abu Zaid**

NMRR ID: NMRR-18-2625-43546 (IIR)

Tajuk: **Effectiveness of intensive perioperative nutrition therapy among adults undergoing surgery.**

Tarikh Penyelidikan: **25hb. Mei, 2019**

Penyelia: Pn Amirozlin Binti Amsar (Jabatan Dietetik)

Penyelidikan tuan adalah tertakluk kepada kelulusan *Medical Research Ethics Committee* (MREC) dan *National Medical Research Register* (NMRR), Kementerian Kesihatan Malaysia (MOH).

Sila kemukakan **Laporan Akhir** kepada Pusat Penyelidikan Klinikal (PPK) Hospital Serdang sebaik sahaja penyelidikan tamat .

APPENDIX C

RESPONDENT'S INFORMATION SHEET

PARTICIPANT INFORMATION SHEET AND INFORMED CONSENT FORM

(for adult subjects)

1. **Title of study**: Assessing Malnutrition Status Among Pre-Operative Surgical Patients in Public Hospital

2. **Name of investigator and institution:** Zalina Abu Zaid (Universiti Putra Malaysia), Nurul 'Aqilah Binti Hasan Ashaari (Universiti Putra Malaysia)

3. **Name of sponsor**: Self-sponsored

4. **Introduction:**

   It is important that you understand why the research is being done and what it will involve. Please take your time to read through and consider this information carefully before you decide if you are willing to participate. Ask the study staff if anything is unclear or if you would like more information. After you are properly satisfied that you understand this study, and that you wish to participate, you must sign this informed consent form.

   Your participation in this study is voluntary. You do not have to be in this study if you do not want to. 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. Your refusal to participate or withdrawal will not affect any medical or health benefits to which you are otherwise entitled.

   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 determine the association of socio-demographic, nutritional status (anthropometry measurement, medical history, biochemical data, and dietary intake), malnutrition status and quality of life with functional status among pre-operative surgical patients in Hospital Serdang, Selangor. This research is necessary because there are limited data on assessing functional status of pre-operative surgical patients in Malaysia. It may serve as baseline information for other studies in the future.

   This research will be conducted for duration of 3 months. The expected number of participants are 130 individuals.

6. **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 and completely which will take about 30 minutes of your time. Study team will also access your medical records for your biochemical data.

   You will be interviewed by the researcher using interviewer-administered questionnaire. This form contains 6 sections which will enquire about your socio-demographic, anthropometry measurements, biochemical data, medical history, dietary intake, malnutrition status, quality of life and functional status. Your weight and height will be measured by the researcher. After that, your diet history will be assessed by the researcher.

Then, you will also need to sit straightly with arms by your side of body and elbow flex at 90 degree to have researcher measure your hand grip strength.

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

   Participation to this study will not affect your treatment, and the risk is minimal. You are free to decline to answer any of the questions that you feel uncomfortable with.

8. **What are the benefits of being in this study?**

   There may or may not be any benefits to you. Information obtained from this study will help improve the treatment or management of other participants with the same disease or condition.

9. **Who is funding the research?**

   This study is self-sponsored. You will not be paid for participating in this study.

10. **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, qualified monitors and auditors, and governmental or regulatory authorities may inspect the study data, where appropriate and necessary.

11. **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 this study, please contact the researcher of this study, or Nurul 'Aqilah Binti Hasan Ashaari at telephone number 0175858947 email to nurulaqilahhasan98@gmail.com . You may also contact the researcher's supervisor, Dr. Zalina bt Abu Zaid at telephone number 03-86092961.

    If you have any questions about your rights as a participant in this study, please contact: The Secretary, Medical Research & Ethics Committee, Ministry of Health Malaysia, at telephone number 03-3362 8407/8205/8888/8100.

APPENDIX C

RESPONDENT'S CONCENT FORM

INFORMED CONSENT FORM

Title of Study: Assessing Malnutrition Status Among Pre-Operative Surgical Patients

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 anytime 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:

Signature: I/C number:

Name: Date:

APPENDIX D

QUESTIONNAIRE

CONFIDENTIAL*/ **SULIT*

Reference Number

QUESTIONNAIRE

BORANG SOAL SELIDIK

Associations of socio-demographic, nutritional status, malnutrition status and quality of life with functional status among pre-operative surgical patients in public hospital

Penghubungkait antara faktor-faktor socio-demografi, status pemakanan, status malnutrisi dan kualiti kehidupan dengan fungsi keupayaan dalam kalangan pesakit sebelum pembedahan di hospital awam

Supervisor/Pemantau: DR. ZALINA BINTI ABU ZAID

Researcher/Penyelidik:

NURUL 'AQILAH BINTI HASAN ASHAARI

Data collection date: ____/____/_____

SECTION A/ *BAHAGIAN A*

SOCIODEMOGRAPHIC BACKGROUND/ *LATAR BELAKANG SOSIODEMOGRAFI*

Fill in the blank or tick the boxes for the questions below. / *Isi tempat kosong atau tandakan kotak yang berkenaan untuk soalan-soalan di bawah.*

No/ *Bil*	**Information/ *Maklumat***	**Options/ *Pilihan***
1	Date of birth/ *Tarikh lahir*	___ ___ / ___ ___ / ___ ___ ___ ___ dd/ *hh* mm/ *bb* yyyy/ *tttt*
2	Age/ *Umur*	___ ___ years old/ *tahun*
3	Gender/ *Jantina*	□ Male/ *Lelaki* □ Female/ *Perempuan*
4	Ethnicity/ *Kaum*	□ Malay/ *Melayu* □ Chinese/ *Cina* □ Indian/ *India* □ Others/ *Lain-lain* Please specify/ *Sila nyatakan*: ……
5	Educational level/ *Tahap pendidikan*	□ Tertiary Education/ *Pendidikan Tertiari* □ Secondary Education/ *Sekolah Menengah* □ Primary Education/ *Sekolah Rendah* □ No Formal Education/ *Tiada Pendidikan Formal*
6	Occupation/ *Pekerjaan*	□ Student/ *Pelajar* □ Employee/ *Pekerja* □ Self-employed/ *Bekerja sendiri* □ Retired/ *Bersara* □ Unemployed/ *Tidak bekerja*
7	Current living status/ *Status hidup semasa*	□ None/ *Tiada* □ Own family/ *Keluarga sendiri* □ Parents/ *Ibu bapa* □ Relatives/ *Saudara mara*

		□ Others/ *Lain-lain* Please specify/ *Sila nyatakan*: ……
8	Marital status/	□ Single/ *Bujang* □ Married/ *Berkahwin* □ Others/ *Lain-lain*
9	Income per month/ *Pendapatan sebulan*	□ RM 0 – RM500 □ RM 501 – RM 1000 □ RM 1001 – RM 2000 □ RM 2001 – RM 3000 □ > RM 3000

SECTION B/ *BAHAGIAN B*

ANTHROPOMETRIC MEASUREMENTS/ *UKURAN ANTROPOMETRI* (Will be filled by the researcher/ *Akan diisi oleh penyelidik*)

1	Weight on admission/ *Berat semasa kemasukan ward*		
	1st reading/ *Bacaan pertama* (kg)	2nd reading/ *Bacaan kedua* (kg)	Average/ *Bacaan purata*(kg)
2	Usual weight/ *Berat kebiasaan* (kg)		
3	Weight loss/ *Perubahan berat* (%)		
4	Duration of weight change/ *Tempoh perubahan berat*		
5	Height/ *Tinggi* (m)		
6	Body Mass Index/ *Indeks Jisim Badan* (kg/m^2)		
7	Triceps skinfold/ *Lipatan triceps*		
	1st reading/ *Bacaan pertama* (cm)	2nd reading/ *Bacaan kedua* (cm)	Average reading/ *Bacaan Purata* (cm)

SECTION C/ BAHAGIAN C

MEDICAL HISTORY/ *SEJARAH MEDIKAL* (To be filled by researcher by referring to medical records/ *Akan diisi oleh penyelidik*)

1. Date to undergo surgical procedure: _____ (date/year)
2. Primary cause(s) of undergoing elective surgery: _____
3. Expected duration of stay: _____ (days)
4. Major co-morbidities:

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

SECTION D/ *BAHAGIAN D*

BIOCHEMICAL DATA/ *DATA BIOKIMIA* (Will be filled by the researcher/ *Akan diisi oleh penyelidik*)

1.	Albumin (g/dL)	
2.	Hemoglobin (g/dL)	
3.	Total lymphocyte count (TLC) (cells/m^3)	

SECTION E/ *BAHAGIAN E*

24-HOUR DIET RECALL/ *24-JAM PENGAMBILAN DIET* (Will be filled by the researcher/ *Akan diisi oleh penyelidik*)

Time/ *Masa*	Food item/ *Item makanan*	Amount/ *Jumlah*

ORAL NUTRITION SUPPLEMENT (ONS)

Are you been taking any of oral nutrition supplement? / *Adakah anda mengambil ONS?*

☐ Yes/ *Ya*

☐ No/ *Tidak*

If yes, please specify/ *Jika ya, sila nyatakan*

……

Prescribed by/ *Dipreskripsikan oleh*:

……

SECTION F / BAHAGIAN F

PATIENT GENERATED – SUBJECT GLOBAL ASSESSMENT (Will be filled by researcher/ *Akan diisi oleh penyelidik*)

Scored Patient-Generated Subjective Global Assessment (PG-SGA)

History: Boxes 1 - 4 are designed to be completed by the patient.
[Boxes 1-4 are referred to as the PG-SGA Short Form (SF)]

Patient Identification Information

1. Weight *(See Worksheet 1)*

In summary of my current and recent weight:

I currently weigh about ____kg
I am about ____ cm tall

One month ago I weighed about ____ kg
Six months ago I weighed about ____ kg

During the past two weeks my weight has:
☐ decreased (1) ☐ not changed (0) ☐ increased (0)

Box 1 ☐

2. Food intake: As compared to my normal intake, I would rate my food intake during the past month as

☐ unchanged (0)
☐ more than usual (0)
☐ less than usual (1)

I am now taking
☐ *normal food* but less than normal amount (1)
☐ little solid food (2)
☐ only liquids (3)
☐ only nutritional supplements (3)
☐ very little of anything (4)
☐ only tube feedings or only nutrition by vein (0) Box 2 ☐

3. Symptoms: I have had the following problems that have kept me from eating enough during the past two weeks (check all that apply)

☐ no problems eating (0)
☐ no appetite, just did not feel like eating (3)
☐ nausea (1)
☐ constipation (1)
☐ mouth sores (2)
☐ things taste funny or have no taste (1)
☐ problems swallowing (2)
☐ pain; where? (3) _____
☐ other (1)** _____
☐ vomiting (3)
☐ diarrhea (3)
☐ dry mouth (1)
☐ smells bother me (1)
☐ feel full quickly (1)
☐ fatigue (1)

**Examples: depression, money, or dental problems Box 3 ☐

4. Activities and Function:
Over the past month, I would generally rate my activity as:

☐ normal with no limitations (0)
☐ not my normal self, but able to be up and about with fairly normal activities (1)
☐ not feeling up to most things, but in bed or chair less than half the day (2)
☐ able to do little activity and spend most of the day in bed or chair (3)
☐ pretty much bed ridden, rarely out of bed (3)

Box 4 ☐

The remainder of this form is to be completed by your doctor, nurse, dietitian, or therapist. Thank you.

Additive Score of Boxes 1-4 ☐ A

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Scored Patient-Generated Subjective Global Assessment (PG-SGA)

Worksheet 1 – Scoring Weight Loss

To determine score, use 1-month weight data if available. Use 6-month data only if there is no 1-month weight data. Use points below to score weight change and add one extra point if patient has lost weight during the past 2 weeks. Enter total point score in Box 1 of PG-SGA.

Weight loss in 1 month	Points	Weight loss in 6 months
10% or greater	4	20% or greater
5-9.9%	3	10- 19.9%
3-4.9%	2	6- 9.9%
2-2.9%	1	2- 5.9%
0-1.9%	0	0- 1.9%

Numerical score from Worksheet 1 ☐

Additive Score of Boxes 1-4 (See Side 1) ☐ A

5. Worksheet 2 – Disease and its relation to nutritional requirements:

Score is derived by adding 1 point for each of the following conditions:

- ☐ Cancer
- ☐ Presence of decubitus, open wound or fistula
- ☐ AIDS
- ☐ Presence of trauma
- ☐ Pulmonary or cardiac cachexia
- ☐ Age greater than 65
- ☐ Chronic renal insufficiency

Other relevant diagnoses (specify) _____

Primary disease staging (circle if known or appropriate) I II III IV Other

Numerical score from Worksheet 2 ☐ B

6. Worksheet 3 – Metabolic Demand

Score for metabolic stress is determined by a number of variables known to increase protein & caloric needs. **Note:** Score fever intensity or duration, whichever is greater. The score is additive so that a patient who has a fever of 38.8 °C (3 points) for < 72 hrs (1 point) and who is on 10 mg of prednisone chronically (2 points) would have an additive score for this section of 5 points.

Stress	none (0)	low (1)	moderate (2)	high (3)
Fever	no fever	> 37.2 and < 38.3	≥ 38.3 and < 38.8	≥ 38.8 °C
Fever duration	no fever	< 72 hours	72 hours	> 72 hours
Corticosteroids	no corticosteroids	low dose (< 10 mg prednisone equivalents/day)	moderate dose (≥ 10 and < 30 mg prednisone equivalents/day)	high dose (≥ 30 mg prednisone equivalents/day)

Numerical score from Worksheet 3 ☐ C

7. Worksheet 4 – Physical Exam

Exam includes a subjective evaluation of 3 aspects of body composition: fat, muscle, & fluid. Since this is subjective, each aspect of the exam is rated for degree. Muscle deficit/loss impacts point score more than fat deficit/loss. Definition of categories: 0 = no abnormality, 1+ = mild, 2+ = moderate, 3+ = severe. Rating in these categories is *not* additive but are used to clinically assess the degree of deficit (or presence of excess fluid).

Muscle Status		Fat Stores	
temples (temporalis muscle)	0 1+ 2+ 3+	orbital fat pads	0 1+ 2+ 3+
clavicles (pectoralis & deltoids)	0 1+ 2+ 3+	triceps skin fold	0 1+ 2+ 3+
shoulders (deltoids)	0 1+ 2+ 3+	fat overlying lower ribs	0 1+ 2+ 3+
interosseous muscles	0 1+ 2+ 3+	Global fat deficit rating	0 1+ 2+ 3+
scapula (latissimus dorsi, trapezius, deltoids)	0 1+ 2+ 3+	**Fluid status**	
thigh (quadriceps)	0 1+ 2+ 3+	ankle edema	0 1+ 2+ 3+
calf (gastrocnemius)	0 1+ 2+ 3+	sacral edema	0 1+ 2+ 3+
Global muscle status rating	0 1+ 2+ 3+	ascites	0 1+ 2+ 3+
		Global fluid status rating	0 1+ 2+ 3+

Point score for the physical exam is determined by the overall subjective rating of the total body deficit.

No deficit	score = 0 points
Mild deficit	score = 1 point
Moderate deficit	score = 2 points
Severe deficit	score = 3 points

Again, muscle deficit/loss takes precedence over fat loss or fluid excess.

Numerical Score for Worksheet 4 ☐ D

Total PG-SGA Score (Total numerical score of A+B+C+D) ☐

Clinician Signature _____ RD RN PA MD DO Other _____ Date _____

Global PG-SGA Category Rating (Stage A, Stage B or Stage C) ☐

Worksheet 5 – PG-SGA Global Assessment Categories

Category	Stage A Well-nourished	Stage B Moderate/suspected malnutrition	Stage C Severely malnourished
Weight	No weight loss OR recent non-fluid wt gain	≤ 5% loss in 1 month (≤ 10% in 6 months) OR Progressive weight loss	> 5% loss in 1 month (> 10% in 6 months) OR Progressive weight loss
Nutrient intake	No deficit OR Significant recent improvement	Definite decrease in intake	Severe deficit in intake
Nutrition Impact Symptoms (NIS)	None OR significant recent improvement allowing adequate intake	Presence of NIS (Box 3 of PG-SGA)	Presence of NIS (Box 3 of PG-SGA)
Functioning	No deficit OR Significant recent improvement	Moderate functional deficit OR Recent deterioration	Severe functional deficit OR Recent significant deterioration
Physical Exam	No deficit OR chronic deficit but with recent clinical improvement	Evidence of mild to moderate loss of muscle mass &/or muscle tone on palpation &/or loss of SQ fat	Obvious signs of malnutrition (e.g., severe loss muscle, fat, possible edema)

Nutritional Triage Recommendations:

Additive score is used to define specific nutritional interventions including patient & family education, symptom management including pharmacologic intervention, and appropriate nutrient intervention (food, nutritional supplements, enteral, or parenteral triage).

First line nutrition intervention includes optimal symptom management.

Triage based on PG-SGA point score

0-1	No intervention required at this time. Re-assessment on routine and regular basis during treatment.
2-3	Patient & family education by dietitian, nurse, or other clinician with pharmacologic intervention as indicated by symptom survey (Box 3) and lab values as appropriate.
4-8	Requires intervention by dietitian, in conjunction with nurse or physician as indicated by symptoms (Box 3).
≥ 9	Indicates a critical need for improved symptom management and/or nutrient intervention options.

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