MALNUTRITION SCREENING AMONG CANCER PATIENTS IN HOSPITAL UNIVERSITI SAINS MALAYSIA

by

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Dissertation submitted in partial fulfilment

of the requirements for the degree of

Bachelor of Health Sciences (Honours) Dietetics

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CERTIFICATE

This is to certify that the dissertation entitled "MALNUTRITION SCREENING AMONG CANCER PATIENTS IN HOSPITAL UNIVERSITI SAINS MALAYSIA" is the bona fide record of research work done by Ms CHOO YI CHING during the period from September 2017 to June 2018 under my supervision. I have read this dissertation and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation to be submitted in partial fulfilment for the degree of Bachelor of Health Science (Honours) (Dietetics).

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DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated and duly acknowledged. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at Universiti Sains Malaysia or other institutions. I grant Universiti Sains Malaysia the right to use the dissertation for teaching, research and promotional purposes.

Date: 12 JUNE 2018

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LIST OF ABBREVIATIONS

AND	The Academy of Nutrition and Dietetics
ASPEN	American Society for Parenteral and Enteral Nutrition
AUROC	Area Under the curve of Receiver Operating Characteristics
BMI	Body Mass Index
FN	False Negative
FP	False Positive
HUSM	Hospital Universiti Sains Malaysia
IQR	Interquartile range
MNA-SF	Mini-Nutritional Assessment Short Form
MST	Malnutrition Screening Tool
MUST	Malnutrition Universal Screening Tool
NPV	Negative Predictive Value
NRI	Nutritional Risk Index
NRS-2002	Nutrition Risk Screening 2002
PPV	Positive Predictive Value
QoL	Quality of Life
RMNST	Royal Marsden Nutrition Screening Tool
ROC	Receiver Operating Characteristics
Scored PG-SGA	Scored Patient-Generated Subjective Global Assessment
SD	Standard Deviation
SGA	Subjective Global Assessment
TN	True Negative
TP	True Positive
SPSS	Statistical Package for Social Sciences
SNAQ	Short Nutritional Assessment Questionnaire
WHO	World Health Organization

PEMERIKSAAN MALNUTRISI DALAM KALANGAN PESAKIT KANSER DI HOSPITAL UNIVERSITI SAINS MALAYSIA

ABSTRAK

Malnutrisi merupakan salah satu isu pemakanan yang sepatutnya ditimbang dalam kalangan pesakit kanser dan isu ini akan memberikan kesan klinikal yang negatif terhadap mereka. Pemeriksaan malnutrisi telah disarankan supaya menjadikan sebagai langkah pertama untuk mengenalpasti risiko malnutrisi dalam kalangan pesakit kanser. Kajian ini bertujuan untuk mengenalpasti ketepatan penggunaan borang *Malnutrition Screening Tool* (MST) dalam pemeriksaan malnutrisi antara pesakit kanser di Hospital Universiti Sains Malaysia (HUSM). MST telah dibanding dengan *scored Patient-Generated Subjective Global Assessment* (scored PG-SGA) sebagai standard. Seramai 94 responden yang dilayak dan berminat, menerima rawatan sama ada di dalam wad atau Unit Perubatan Nuklear, Radioterapi & Onkologi terlibat dalam kajian ini. Data sosio-demografi dan sejarah kesihatan responden telah dikaji dari rekod kesihatan. Berat badan dan ketinggian responden telah diukur dengan *dial mechanical weighing scale with height rod* yang disediakan di tempat kajian masing-masing. Dua set borang soal selidik – MST dan scored PG-SGA telah digunakan sepanjang temuduga dengan responden. Data adalah dianalisis dengan *Statistical Package for Social Sciences* (SPSS) versi 24.0. Daripada jumlah 94 responden, 62.8% adalah wanita manakala 37.2% adalah lelaki. 72.3% adalah pesakit dalam manakala 26.8% adalah pesakit luar. 40.4% responden yang didiagnos dengan kanser hematologi. Berdasarkan scored PG-SGA, 64.9% responden didapati malnutrisi manakala 35.1% responden adalah tanpa malnutrisi. Kebanyakan responden yang malnutrisi (72.1%) adalah pesakit dalam (p=0.019). Responden yang malnutrisi

mempunyai berat badan dan BMI yang signifikan rendah manakala peratusan pengurangan berat badan dalam enam bulan lepas signifikan banyak (p<0.001). Skor MST dan skor PG-SGA juga signifkan tinggi dalam kalangan responden yang malnutrisi (p<0.001). Selain itu, MST menghasilkan 72.1% sensitiviti, 93.9% specificiti, 95.7% nilai ramalan positif dan 64.6% nilai ramalan negatif. Skor MST dan skor PG-SGA mempunyai korelasi positif yang signifikan dan sederhana kuat (r = 0.734, p<0.001). Konklusinya, MST adalah diterima sebagai alat pemeriksaan risiko malnutrisi dalam kalangan pesakit kanser.

MALNUTRITION SCREENING AMONG CANCER PATIENTS IN HOSPITAL UNIVERSITI SAINS MALAYSIA

ABSTRACT

Malnutrition is one of the nutritional issues that we should concern among cancer patients and it is negatively associated with poor clinical outcomes. Nutrition screening has been supported to work as the foremost step in identifying the nutritional risk of cancer patients. This cross-sectional study aimed to determine the accuracy of Malnutrition Screening Tool (MST) in detecting malnutrition risk among cancer patients in Hospital Universiti Sains Malaysia (HUSM). The MST was compared against scored Patient-Generated Subjective Global Assessment (scored PG-SGA) as gold standard. 94 respondents who full-filled the inclusion criterion and interested, admitted to HUSM and Department Nuclear Medicine, Radiotherapy & Oncology were recruited through convenience sampling. Socio-demographic characteristics and clinical data of respondents were obtained from their medical record. Weight and height were measured using dial mechanical weighing scale with height rod which provide in respective setting. Two sets of questionnaires – MST and scored PG-SGA were then subsequently used to interview respondents. The data was analysed using Statistical Package for Social Sciences (SPSS) version 24.0. Out of 94 respondents, 62.8% was female while 37.2% was male. 72.3% was hospitalised whereas 27.7% was from outpatient. Highest proportion of respondents (40.4%) was diagnosed with hematologic cancer. According to scored PG-SGA, 64.9% of respondents was classified as malnourished while 35.1% of them was classified as well-nourished. Significantly higher proportion of malnourished respondents was from inpatients (p=0.019). Malnourished respondents had significantly lower body weight,

BMI and higher percentage of weight loss for the past 6 months (p<0.001). MST score and PG-SGA score were also significantly higher among malnourished respondents (p<0.001). Next, MST yielded 72.1% sensitivity, 93.9% specificity, 95.7% positive predictive value and 64.6% negative predictive value. There is statistically significant, positive and moderately strong correlation between MST score and PG-SGA score (r = 0.734, p<0.001). In conclusion, MST is recommended as screening tool in predicting malnutrition risk among cancer patients.

CHAPTER 1: INTRODUCTION

1.1 Background of study

Cancer had been accounted for 13.56% of total death in Malaysia according to the latest database from Malaysian National Cancer Registry Report 2007-2011 (Azizah *et al.*, 2016). Overall of 103,507 new cancer cases had been reported in Malaysia from 2007 to 2011. The top three common cancers for female are breast (32.1%), colorectal (10.7%) and cervix uteri (7.7%) whereas top three common cancers for male are colorectal (16.3%), lung (15.8%) and nasopharyngeal (8.1%). Cancer patients usually have higher chances to face with challenges of imbalance between sufficient energy intake, increase of nutritional needs and decrease availability of nutrient store in body due to body defense towards cancerous cell. Prolonged negative energy balance is progressively lead to malnutrition and may proceed to a condition which known as cancer cachexia, a specific syndrome that characterised by involuntary weight loss, muscle loss and anorexia (Argiles, 2005).

Malnutrition is negatively associated with clinical outcomes including increased morbidity and mortality rate, prolonged length of stay and treatment cost as well as poor quality of life (QoL) and decreased their survival rate (Nicolini *et al.*, 2013). This nutritional issue is more concerned especially among those who receive cancer treatments such as radiotherapy, chemotherapy and surgery as these may further induce significant health impacts towards patients like change of appetite, gastrointestinal symptoms, fatigue and pain (Santarpia *et al.*, 2011). The prevalence rate of malnutrition associated

with cancer has been estimated as high as 80.0% within the population (von Haehling and Anker, 2010). Therefore, early recognition and identification of malnutrition risk by healthcare professionals among cancer patients is believed to be better in improving future care delivery.

Nutrition screening is defined by The Academy of Nutrition and Dietetics (AND) as 'a process to identify patients or group of clients who may have nutrition diagnosis (at risk of malnutrition) and benefit from detailed nutrition care process by dietitian. It must be a quick, simple, non-invasive procedure which can be performed by each healthcare professionals without formal training. Nutrition screening is supported to work as the foremost step in detecting the nutritional risk before proceeding to comprehensive nutrition assessment and intervention from dietitian. In contrast, there is a difference between nutrition screening and nutrition assessment. Screening is mainly to determine 'risk' of problem but assessment is to identify the 'root cause' of particular problem (Davies, 2005; Field and Hand, 2015). The validity of objective nutrition parameters such as anthropometric and laboratory markers have shown contraindication to assess the nutritional status as they are affected by many other factors (Bauer *et al.*, 2002). It is essential for healthcare workers to choose appropriate and validated screening test which suitable for the care setting, target patient population and nutritional goal. A good screening tool should be highly sensitive to detect the malnutrition risk of nearly whole targeted population. All of the variables in the screening tool must grade with score, and hence, to quantify the degree of malnutrition risk and determine the direction of nutritional assessment. Any use of invalidated and improper screening tool may lead to false classifying nutritional risk and missing those who require true intervention (Anthony, 2008; Kondrup *et al.*, 2003; Leuenberger *et al.*, 2010).

There are wide variation of standardized nutrition screening tools which are available and can be applied within clinical setting, ranging from Malnutrition Screening Tool (MST), Short Nutritional Assessment Questionnaire (SNAQ), Mini-Nutritional Assessment Short Form (MNA-SF), Nutrition Risk Screening 2002 (NRS-2002), Subjective Global Assessment (SGA) and Malnutrition Universal Screening Tool (MUST). However, they may require to re-validate in different target clinical care setting in order to maintain high accuracy and reliability of results (Anthony, 2008; Kondrup *et al.*, 2003). The validity of screening tools can be performed through two ways which are tested against valid screening tool (convergent validity) or against valid assessment tool (predictive validity) (Field and Hand, 2015).

The MST is a simple, quick, non-invasive and less skill required which uses the following criterion to identify patients at nutritional risk: unintentional weight loss for the past six months and recent decreased appetite. It is previously developed against SGA (as gold standard) and proved high sensitivity and specificity among adult acute hospitalised patient (Ferguson *et al.*, 1999a).

Patient-Generated Subjective Global Assessment (PG-SGA) is an assessment tool which had been developed specifically for oncology population by Ottery (1996). Further incorporation of scoring system by the creator making the PG-SGA a better assessment tool to identify the level of nutritional intervention and nutrition triage recommendation for respective groups of patients (Bauer *et al.*, 2002). In order to facilitate accurate nutritional screening that can be applied in cancer setting of HUSM, selection of a uniform and accurate screening tool has become an important issue that we concerned.

1.2 Problem statement

Deterioration of nutritional status among cancer population largely effect on their survival rate and it is found that 20.0% of cancer patients are actually died from the consequences of malnutrition despite of the malignancy (Capra *et al.*, 2001). Nutrition assessment tools like scored PG-SGA even though consist of comprehensive and complex components, it is time consuming for healthcare professionals to complete them on all admitted patients within short period of time. Besides, its development aimed to provide an in-depth and comprehensive nutrition assessment which largely require input of formal dietitian (Isenring and Elia, 2015). Hence, presence of nutrition screening is potentially become alternative method to identify nutritional risk of cancer patients at first hospital admission or visit to oncology clinic. However, unlike elderly population, there is no standard mean of nutrition screening tool that designed specifically for cancer patient and this causes difficulty for healthcare professionals to determine nutritional risk accurately. Most of the existing screening tools are validated in general hospitalised population and only few of them have been validated in cancer population. In addition, the same screening tool is required to re-access in different clinical care setting to ensure the respective tool is fit with current healthcare setting and truly identify the appropriate nutrition intervention for patients (Anthony, 2008).

One of the popular screening tool is MST and it had been validated by researchers for its efficacy that mostly involved generalised inpatient and oncology outpatient. Initially, this tool is designed for the screening of adult acute hospital patients and it is strongly predicted the nutritional status of acute care patients (Ferguson *et al.*, 1999a). Evidence has pointed out that MST has higher sensitivity of 100.0% and 92.0% of

specificity against PG-SGA when applied in oncology outpatient receiving chemotherapy at Australian Public Hospital (Isenring *et al.*, 2006). However, another study has showed that MST has poorer sensitivity against PG-SGA when compared with other screening tool in oncology inpatient setting (Shaw *et al.*, 2015). There is lacking of consensus of MST in the screening of malnutrition among cancer patients. Therefore, it is questionable the accuracy of MST in predicting malnutrition risk among oncology population. On top of that, there is no previous local study which is conducted to compare the accuracy of MST against PG-SGA among cancer setting.

1.3 Conceptual framework

Figure 1.1 shows the conceptual framework of biological factors which lead to malnutrition among cancer patients such as tumour related mechanisms and types of cancer treatments. Other non-nutritional factors such as socioeconomic status, educational level and level of awareness of medical staffs. Consequences of malnutrition including increased mortality and morbidity rate, reduced QoL, increased healthcare cost and length of stay. Nutrition screening tool is supported as the first procedure to detect the malnutrition risk among cancer patients and it is considered as one of the subjective assessment methods. Other objective assessment methods including laboratory biomarkers, anthropometric measurements, functional test and dietary assessment (Barbosa-Silva, 2008).

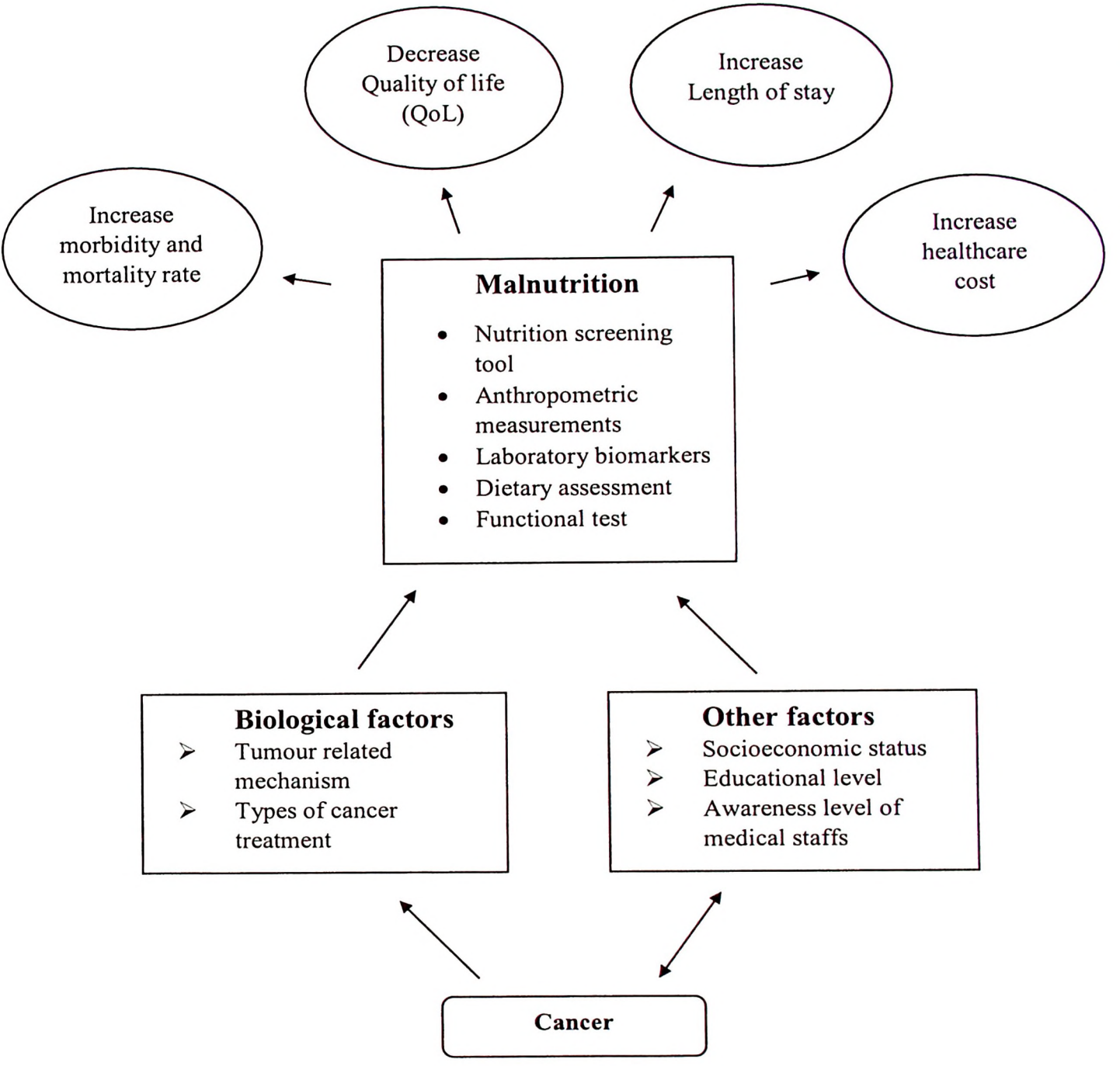

Figure 1.1: Conceptual framework

1.4 Research objectives

General objective

To determine accuracy of MST in detecting malnutrition risk among cancer patients in HUSM.

Specific objectives

a. To determine prevalence of malnutrition among cancer patients in HUSM.
b. To determine the sensitivity, specificity and predictive value of MST in screening malnutrition risk among cancer patients compared against scored PG-SGA.
c. To determine the correlation between MST score and PG-SGA score.

1.5 Research questions

1. What is the prevalence of malnutrition among cancer patients in HUSM?
2. How the sensitivity, specificity and predictive value of MST to detect malnutrition risk among cancer patients in HUSM?
3. How the correlation between MST score and PG-SGA score?

1.6 Research hypothesis

Null hypothesis (H_0): There is no correlation between MST score and PG-SGA score.

Alternative hypothesis (H_A): There is correlation between MST score and PG-SGA score.

1.7 Significance of study

Nutrition screening has been known as the first and foremost procedure to determine one's nutritional status prior to nutrition assessment so that any malnutrition risk can be detected earlier and able to provide suitable nutritional intervention to patient by nutrition professional. This can help to prevent the onset or progression of malnutrition. As there is lacking of local study regarding prevalence of malnutrition among cancer population, hence, it can be determined via conducting this study. This study is also significant to determine the extent of sensitivity, specificity and predictive value of MST in screening of malnutrition risk among cancer setting in HUSM. This may aid in suggestion of MST as a screening tool in HUSM in future time as currently there is no screening tool that has been practiced in HUSM. Besides, it also provides the knowledge to the healthcare professionals regarding the essential of early screening practice among cancer patients in order to accurately determine their nutritional needs and reduce their morbidity rate.

CHAPTER 2: LITERATURE REVIEW

2.1 Pathophysiology of malnutrition among cancer patients

Malnutrition is one of the common negative outcomes which associated with cancer patients. Sometimes, it could be under-recognised in clinical setting due to lack of universal definition which is available for malnutrition as well as inadequacy of nutrition assessment to show improvement throughout process of nutrition therapy (Toulson Davisson Correia, 2018). AND together with the American Society for Parenteral and Enteral Nutrition (ASPEN) have come to a consensus statement: Characteristics Recommended for the Identification and Documentation of Adult Malnutrition which aids healthcare professionals in the identification of malnutrition of adults. There are six criterion that should be used to identify and diagnose malnutrition and at least two criterion should be fulfilled for the diagnosis to be available. These criterion including insufficient energy intake, weight loss, localised or generalised fluid accumulation, diminished functional status, loss of muscle mass and loss of subcutaneous fat (Dobak *et al.*, 2017; White *et al.*, 2017).

The pathophysiology of cancer leading to malnutrition is complicated and multifactorial which involving various mechanism. One of the pathophysiology is explained through tumour-related mechanism in which the growth of tumour may induce functionality changes, metabolism abnormalities and site-related obstruction to patients, resulting in insufficient energy and essential nutrients to fight against cancerous cells (Nicolini *et al.*, 2013). For example, patients who suffering head and neck cancer are

unable to consume sufficient nutrient due to tumour location. When absence of adequate exogenous nutrient intake, the body will start to breakdown the endogenous nutrient store such as skeletal muscles, internal organs and adipose tissue for sustainable growth of body tissues and tumour cells (Daly, 1986). Prolonged inadequate nutrient intake accompanied with rapid body metabolism turnover adversely affect the body function of cancer patient and one of the significant changes is weight loss due to wasting of muscle (Argiles, 2005). Weight loss either reports in percentage (>5.0% or 10.0%) or amount (5kg or 10kg) within specific period of time frame (1 month or 6 months), compared to usual weight. Significant weight loss is considered as percentage of weight loss $\geq$ 10% over the past 6 months. However, the impact of weight loss may be sometimes overlooked especially among those overweight or obese patients as they may pay less attention on this issue (Martin *et al.*, 2010; Pressoir *et al.*, 2010).

Another etiology is due to anti-cancer treatment like certain surgery, chemotherapy and radiotherapy that worsen the condition of patients. Surgery especially those involving head-and-neck and parts of digestive system will increase the malnutrition risk among patients by interfering their ability of mastication, swallowing and digestion function. In addition, chemotherapy which using biological drugs usually causes nausea, vomiting and diarrhea while radiotherapy involves the use of irradiation can cause xerostomia, mucositis and emesis (Nicolini *et al.*, 2013). 57.0% of cancer patients reported of reduced oral intake due to several gastrointestinal symptoms including change of taste, difficulty of swallowing, loss of appetite and nausea (Gyan *et al.*, 2018). In a cross sectional study to investigate malnutrition factors among hospitalised cancer patients by Silva *et al.* (2015), pain, dysgeusia, anorexia and vomiting attribute to the highest prevalence of reporting nutritional impact symptoms among 67.1% of the

samples. Nutrition impact symptom is defined as symptoms which will negatively impact on nutritional status and increase malnutrition risk (Tong *et al.*, 2009). Despite of the biological factors, other non-nutritional factors such as socioeconomic status, educational level and awareness of medical staff also indirectly affect the nutritional status (Silva *et al.*, 2015).

2.2 Consequences of malnutrition

Untreated malnutrition is undoubtedly lead to an increase risk of morbidity including poor wound healing, weaken immunity against infectious diseases and pressure ulcer. This might due to higher protein turnover rate and reduce the production of antibodies that fight against microorganisms. It can also lead to malabsorption due to atrophy of intestinal lining and reducing the total surface area of absorption. Thus, this further contributes to malnutrition problem (Argiles, 2005). Furthermore, malnutrition also reduces patient's tolerance towards anti-cancer treatment due to the necessity to adjust dose of cytotoxic agent or radiation timing. All of these consequences are associated with higher rates of re-admission, prolonged of hospital stay, decreased QoL and indirectly contribute to hospital financial burden (Argiles, 2005; Tappenden *et al.*, 2013). Prolonged hospital stay is expected to increase by 45.0% among malnourished groups (Pressoir *et al.*, 2010). Besides, study also revealed that there is significant correlation between the severities of malnutrition with the QoL of cancer patients. The researchers found that when there is change of PG-SGA score of nine, it can decrease their QoL score by 17 points (Bauer *et al.*, 2002).

2.3 Prevalence of malnutrition among cancer patients

The prevalence of malnutrition is ranged variously among cancer patients in different setting and it can be affected by disease itself (type, location, stage and grade of cancer), anti-cancer treatment or patient characteristics like gender and age (Argiles, 2005). In a local, cross-sectional study which had been conducted in National Cancer Institute at Putrajaya, Malaysia between August 2014 and January 2015, the researchers found that out of 97 respondents, 43.5% of patients (n=39) were mild to severe malnourished using SGA classification with 69.7% of them was in Stage 4 (metastases disease). Majority of the malnourished patients were diagnosed with nasopharyngeal cancer and lung cancer, 30.7% and 20.5% respectively. The mean SGA score was 6.1±5.7 that indicated them at mild malnourished category. Men accounted for 56.4% of malnourished respondents compared to women. However, 66.7% of them was classified as normal, overweight and obese though they were malnourished (Norshariza *et al.*, 2017).

Besides, in another cross-sectional study which conducted across 283 private and governmental hospitals in France, 39.0% of them was identified as malnourished with higher percentage for liver and pancreatic cancer which accounted for 55.0% and 54.0% respectively (Gyan *et al.*, 2018). Similar rate was found across 1903 cancer patients in French. Out of the total prevalence which is 39.0% of malnutrition, hospitalised cancer patients accounted higher rate (44.1%) than outpatient (27.7%). The definition of malnutrition used in this study was BMI and percentage of weight loss more than 10% since disease onset (Hebuterne *et al.*, 2014). Another study by Pressoir *et al.* (2010) found that the prevalence of malnutrition was 30.9% in voluntary care centers in France.

However, there was only 7.3% of the respondents who had lower BMI which means more than half of malnourished respondents presented with normal BMI.

However, another study which conducted at National Cancer Centre of Korea, it is found that out of 12112 cancer patients who were hospitalised, the results revealed that higher prevalence of 61.0% were malnourished compared to previous studies and higher rate was found in male than female. However, older female respondents had higher malnutrition rate than younger one (Wie *et al.*, 2010). Higher prevalence of 71.7% was also found in a cross-sectional study which involved 277 cancer patients from oncology and palliative care inpatients units of Institute of Integrative Medicine Prof. Fernando Figueira (IMIP) in Brazil. Similar percentage between moderate malnutrition and severe malnutrition categories which are 35.4% and 35.7% respectively according to PG-SGA classification. 80.2% of them had percentage of weight loss at least 5% within the past 6 months with median 14.7% (Silva *et al.*, 2015). Bauer *et al.* (2002) reported that 76.0% of hospitalised patient was malnourished and the age as well as BMI were significant differences between SGA classifications. However, there was no significant difference between sex and nutritional status. Du *et al.* (2017) also reported 86.3% of respondents was classified as malnourished among 927 hospitalised cancer patients with different malignancy tumour according to PG-SGA. It was also found that male had significantly lower median BMI (22.1 kg/m^2) than female (22.7 kg/m^2). When compared the anthropometric parameters between PG-SGA classifications, severely malnourished patients showed the lowest weight (58.0kg) and BMI (21.1 kg/m^2) with $p<0.001$.

Another study which conducted by Pandey *et al.* (2011) among cancer outpatient who received chemotherapy and/or radiotherapy, 25.0% of them was found to be severely

malnourished, 73.5% to be moderately malnourished while 1.5% of them were well-nourished by using PG-SGA classification. The finding was higher compared to inpatient setting as well as other outpatient study. One study which conducted among 60 oncology outpatient who receiving radiotherapy, the researchers found that the prevalence of malnutrition was 35.0% which is comparatively lower than previous study according to SGA classification (Isenring *et al.*, 2003). The finding was similar to Isenring *et al.* (2006) in which the prevalence of malnutrition was 26.0% based on PG-SGA classification, out of 60 outpatients receiving chemotherapy. However, nearly whole population (95.0%) had normal BMI classification. Gabrielson *et al.* (2013) also reported 35.6% of patients was malnourished among outpatient setting and the mean age was significantly older within malnourished patients ($p = 0.001$). Ferguson *et al.* (1999b) found that much lower prevalence of malnutrition which was only 11.0% among 106 patients who receiving radiotherapy at two cancer care centers in Australia.

2.4 Nutrition screening

Nutrition screening is recognised as the most important procedure to identify the malnutrition risk of patients through the most simple, non-invasive and effective way. It is recommended to screen every hospitalised patients within 24 hours upon their admission, followed by repeated screening routinely while screen day care patients during their clinic appointment. Thus, it must be able to perform by medical staffs at a hospital wide basis. Before a screening tool can be applied in any setting, it must be tested against gold standard for validation purpose. Validity defined as the extent of a tool can measure a trait. The gold standard can be either biopsy, lab test results, diagnostic tool or angiography (Anthony, 2008; Davies, 2005). There are four common terms which used

in the validation. Sensitivity is the ability of a test to truly identify the proportion of patients whom present of disease (presence of malnutrition in this context) while specificity is the ability of a test to identify the proportion of patients whom healthy (absence of malnutrition). Next, positive predictive value (PPV) is the percentage of patients who tested positive actually have disease whereas negative predictive value (NPV) is the percentage of patients who tested negative actually do not have disease (Field and Hand, 2015). Usually, 2x2 contingency table will be used to represent sensitivity, specificity, PPV and NPV.

An ideal and valid screening tool should has both 100% sensitivity and specificity which means it able to correctly identify all patients who at risk and not at risk of malnutrition respectively. However, it may be difficult to achieve. Hence, the false negative must be avoided to misclassify those who are at risk of malnutrition under well-nourished. Apart from that, a valid screening tool should also has high PPV and NPV to reduce the need of re-screen by dietitian (Field and Hand, 2015).

2.4.1 Malnutrition Screening Tool

MST is first developed and introduced by Ferguson *et al.* (1999a) among 408 general hospitalised patients. It was validated individually against SGA as gold standard. This study had been conducted at The Wesley Hospital in Bribane, Queensland, Australia for 3 months period using convenience sampling. For the selection of screening questions, the questions which had sensitivity of more than 90.0% were identified. The final combination of screening questions showed that this tool has both sensitivity and specificity of 93.0%. The PPV was 98.4% while NPV was 72.7%. The questions

including weight loss for the past six months and appetite of subjects. The weight loss has been stratified into 4 categories to identify the degree of weight loss in terms of kilogram. Percentage of weight loss does not consider by the founder due to the necessity of calculation. In addition, each category will be rated with respective score. The score of MST ranges from 0 to 5 and cut-off value of 2 indicates at risk of malnutrition. Hence, patients with score 2 to 5 should be prioritised to perform nutritional assessment. Study by Gabrielson *et al.* (2013) found that median MST score was significantly higher among malnourished patients. This makes MST as quick and non-invasive screening tool within hospital inpatient setting and showed both sensitivity and specificity of 78.0% and 96.0% respectively when compared with other malnutrition screening tools (Neelemaat *et al.*, 2011). Even though it was initially developed within general inpatient setting, it has been gradually to validate among cancer population.

In a cross-sectional study which conducted among cancer outpatient who received chemotherapy at Australian Public Hospital, the validity of MST is compared against PG-SGA which is gold standard assessment developed for cancer patient. The study included 51 subjects who attending to chemotherapy unit and eligible for the study. Based on the finding, MST shows sensitivity of 100.0% and specificity of 92.0%. The positive predictive value is 80.0% while negative predictive value is 100.0%. It concludes that MST has higher sensitivity, specificity and predictive value in identifying the risk of malnutrition among chemotherapy outpatients (Isenring *et al.*, 2006). Besides, Ferguson *et al.* (1999b) also found the similar finding in their previous study which conducted among 106 oncology outpatients receiving radiotherapy in two cancer care centers of Australia. SGA was used as gold standard in this validation. No dichotomisation of categories (Stage B and Stage C) was done as none of the respondents had classified at

Stage C. MST has high sensitivity and specificity of 100.0% and 81.0% respectively. The PPV is slightly lower (40.0%) while similar NPV (100.0%).

However, another observation study was conducted to compare MST and Royal Marsden Nutrition Screening Tool (RMNST) against PG-SGA among oncology inpatient in a tertiary care centre. Outcome data for PG-SGA and both MST, RMNST were dichotomised into categories of at risk (malnourished) and not at risk (well-nourished). The finding was slightly contrast in oncology outpatient where the researchers found that MST has lower sensitivity of 66.0% but similar specificity of 83.0%. (Shaw *et al.*, 2015). This showed that MST is a better tool for the estimation of those who are not at risk. Similarly, in another study by Abe Vicente *et al.* (2013) who aimed to investigate the most effective nutrition assessment method in cancer outpatients setting with gastric and colorectal cancer. The study was conducted among 137 patients which was then categorised in two groups – Group 1 consists of patients with gastric or colorectal cancer while Group 2 consists of patients with the same cancer after treatment with follow up. The research team had compared the sensitivity and specificity of three nutrition screening tools namely MUST, MST, Nutritional Risk Index (NRI) and also objective methods like serum albumin, Body Mass Index (BMI) and phase angle against PG-SGA. There were two main findings from this cross-sectional study. First finding showed that screening tool is the most accurate method compared to objective methods as objective methods are commonly associated with other factors. Next, the researchers suggested that MST has the lowest sensitivity of 52.0% but highest specificity of 84.0% compared with the other two tools in the detection of malnutrition risk of gastric or colorectal cancer patients. This might due to incomplete computation of weight history of subjects to standardise MST score.

2.4.2 Scored Patient-Generated Subject Global Assessment

Patient-Generated Subject Global Assessment (PG-SGA) is a nutrition assessment tool which was adapted from SGA especially for oncology patients and the older version only consists of patient-completed medical history section (weight history, food intake, nutrition impact symptoms and functional capacity) and physical assessment section (medical diagnosis, metabolic demand, physical function and SGA rating) which completed by physician, dietitian or nurse staff (Ottery, 1996). The latter modification was done to the PG-SGA in version of scored PG-SGA which including the modification of physical components, scoring system and overall global rating. Scored PG-SGA consists of two sections: medical components (weight loss, nutrition impact symptoms, food intake and functional capacity) and physical components (diagnosis, metabolic demand, physical examination of fat store, muscle status and fluid status). It has been recognised as standard assessment tool for cancer population by the Oncology Nutrition Dietetics Practice Group of the American Dietetic Association (Andreoli *et al.*, 2011).

Each component will be attributed with respective score with the highest score of 3 and require calculation of total numerical score. This eases the healthcare professionals in identifying the severity of malnutrition based on PG-SGA category rating – Stage A, B, C. Stage A indicates well nourished; Stage B indicates mild to moderately malnourished whereas Stage C indicates severely malnourished. In addition, triage for appropriate nutrition intervention was implemented according to the total numerical score obtained. Therefore, total numerical score ranges from 0 to 50 in which higher score indicates higher risk of malnutrition and score ≥ 9 indicates a critical need for nutrition support by dietitian or physician (Ferguson, 2003).

Scored PG-SGA has been validated by few studies and recommended as gold standard for the assessment of nutritional status in oncology setting (Bauer *et al.*, 2002; Du *et al.*, 2017). In an observational study which conducted at oncology ward of private tertiary Australian Hospital, scored PG-SGA questionnaire was validated against SGA for the use of assessing nutritional status of cancer patients. It was found that scored PG-SGA has 98.0% sensitivity and 82.0% of specificity in predicting the SGA groups. When comparing the median score of PG-SGA with SGA classification, the researchers concluded that the highest median score is significantly associated with severely malnourished patients (Bauer *et al.*, 2002). Another study which conducted by Du *et al.* (2017) to compare the effectiveness of PG-SGA and NRS-2002 in the evaluation of nutritional status of cancer patients. It also aimed to determine the clinical value of scored PG-SGA as assessment tool among oncology setting. It was proved that scored PG-SGA has higher sensitivity (93.78%) but lower specificity (21.8%) than NRS-2002 when validated against serum albumin level in 927 hospitalised cancer patients. Furthermore, scored PG-SGA had also be suggested as the most appropriate tool to detect malnutrition among gynecologic patients. The PG-SGA score was significantly higher among malnourished group ($p<0.001$) and positively correlated with total body potassium level.

2.5 Correlation between MST score and PG-SGA score

Both MST and PG-SGA have the scoring system to determine the cut-off point of malnutrition. There is limited published studies which determine the linear relationship between MST score and PG-SGA score. One study which performed by Gabrielson *et al.* (2013) among oncology outpatient who receiving chemotherapy at medical care center, the researcher had found that there was a linear relationship between MST score and PG-

SGA score with correlation coefficient of 0.538, $p<0.001$. The correlation coefficient represented the strength of relationship between both variables. Hence, the linear relationship between MST score and PG-SGA score was considered as moderate but weaker as compared to abridged PG-SGA score and PG-SGA score ($r = 0.984$, $p<0.001$).

CHAPTER 3: MEHTHODOLOGY

3.1 Study design

This was a quantitative, observational, cross-sectional study which involved the use of questionnaires. MST was used to detect the malnutrition risk among cancer patients while scored PG-SGA used as gold standard to test against the sensitivity, specificity and predictive value of MST. The procedures and protocol of this study was submitted to the Human Research Ethics Committee USM for approval (Refer Appendix 1). Application letter regarding research purpose was send to behalf of HUSM as well (Refer Appendix 2).

3.2 Study population

The population involved in this study were adult cancer patients who hospitalised in HUSM or had clinical appointment at Department Nuclear Medicine, Radiotherapy & Oncology for the purposes of chemotherapy, radiotherapy or follow up.

3.3 Study location

This study was carried out in HUSM, Kubang Kerian, Kelantan. Six wards of HUSM including surgical wards (2 *Intan* and 3 *Utara*), haematological and oncology wards (3 *Selatan* and 1 *Timur Depan*), Otorhinolaryngology ward (4 *Timur Depan*) and Gynaecological ward (1 *Utara*). Outpatient was conducted at Nuclear Medicine, Radiotherapy & Oncology Clinic.

3.4 Study participants

Inclusion criteria

The respondents who were recruited for this study must be:

- Adult with 18 years old and above
- Cancer patients who receive chemotherapy and/or radiotherapy and/or surgery or without treatment regardless of newly diagnosed or established malignancy
- Able to understand bahasa Melayu and/or English
- Able to give informed consent
- Ambulate to measure weight and height

Exclusion criteria

This study would not include individual who are:

- Acute medical concern or cognitive impairment defined by medical staffs
- Pregnant woman
- Receiving hematopoietic cell transplant
- Required palliative care and isolation
- Patients on ventilated

3.5 Study period

The study was conducted from February 2018 to March 2018 (Refer Appendix 3).

3.6 Sample size

The sample size of this study was calculated by using Daniel's formula (Daniel, 1999).

$$n = \frac{Z^2 P(1-P)}{d^2}$$, where

n= sample size

Z= Z statistic for a level of confidence at 95%

P= expected prevalence of malnutrition in cancer (0.39)

d= precision (0.10)

The expected prevalence of malnutrition in cancer patients is 39.0% (Hebuterne *et al.*, 2014). Therefore, the calculated samples size was 91 respondents. However, upon taking into consideration of 10% drop out rate, the desired sample size was 100 respondents. Total 100 patients had been approached while 6 of them refused to take part in this study, thus, the response rate was 94.0%. Of 6 respondents who declined, three of them too tired while another three of them were not interested to join.

3.7 Sampling method

The respondents were recruited using convenience sampling. All respondents were voluntarily recruited. Informed consent were obtained from all respondents.

3.8 Study procedures

Ethical approval was obtained from Human Research Ethics Committee USM (USM/JEPeM/17100495). Besides, permission to conduct study was obtained from

Director of HUSM as well. Data collection was started from 05th February 2018 to 24th March 2018 (7 weeks). Informed consent regarding this complete research information was obtained from respondents prior to their recruitment to this study (Refer Appendix 4). Respondents were advised on the aim, procedures, benefits and possible risks of study, as well as their right of refusal. Respondents were given full freedom to participate or not without affecting his/her medical condition management and care. For respondents who volunteered to join, interview session was conducted within 15 minutes per respondent. On the other hand, patients who were not volunteer to join were declined from this study.

Socio-demographic information including age, sex, ethnicity and marital status while clinical data including diagnosis (type of cancer and duration of diagnose), current or previous cancer treatment were obtained from medical record. Current height and weight of respondents were measured using calibrated dial mechanical weighing scale with height rod. Besides, the usual weight for the past one month or six months were self-reported by respondents. The percentage of weight loss for the past six months was calculated in scored PG-SGA as incomplete information reporting for past one month. It was calculated based on the equation: (usual weight – current weight) / usual weight x 100%.

Each respondent was then interviewed with two set of questions – MST and scored PG-SGA. Both sections were conducted by the researcher in this study. For the second section, it was done through collecting data from medical record and physical examination. Total PG-SGA score was calculated and respondents were categorised according to global PG-SGA rating as Stage A, Stage B or Stage C. These stages would represent nutritional status of respondents.