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Prevalence of Malnutrition among Hospitalised Adult Cancer Patients at the National Cancer Institute, Putrajaya, Malaysia

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ABSTRACT

Introduction: Malnutrition in cancer patients affects the quality of life (QoL) of the patients and brings about adverse outcomes including morbidity and mortality. This study aims to determine the prevalence of malnutrition among cancer patients at the National Cancer Institute (NCI), Putrajaya. **Methods:** A cross-sectional study was conducted among 97 respondents who were admitted to the NCI between August 2014 and January 2015. Information on socio-demographic characteristics, clinical characteristics, anthropometric measurements, dietary intake and biochemical data were obtained. The Malnutrition Screening Tool (MST) was used to identify malnutrition risk, while the Subjective Global Assessment (SGA) determined patients' nutritional status. **Results:** Approximately 61.9% and 43.5% of the patients were malnourished upon admission based on the MST and SGA scores, respectively. Four most common types of cancer among the malnourished patients were nasopharyngeal (NPC), lung, breast and colorectal cancer. About 56.9% and 21.6% of the malnourished patients, according to MST, were at Stage 4 and Stage 3 cancer, respectively. Meanwhile 69.7% of the malnourished respondents, based on SGA, were at Stage 4 cancer. Mean energy intake was 1463±577 kcal and protein intake was 54±22 g proteins. **Conclusion:** Prevalence of malnutrition in hospitalised cancer patients in the NCI was high, depending on age, body mass index (BMI), tumour location and cancer stage. Early identification of malnutrition status is required for proper nutritional intervention.

Key words: Cancer, malnutrition, Malnutrition Screening Tool (MST), National Cancer Institute (NCI) Putrajaya, Subjective Global Assessment (SGA)

INTRODUCTION

Cancer is the fourth leading cause of death in Malaysia, contributing to 13.02% of all deaths that occurred in the Ministry of Health Hospitals in 2014. The five most common cancers among males were cancers of the colorectum (16.3%), lung (15.8%), nasopharynx (8.1%), lymphoma (6.8%) and prostate (6.7%). Among females, the five most common were cancers of the breast (32.1%), colorectum (10.7%), cervix uteri (7.7%), ovary (6.1%) and lung (5.6%) (MMinistry of Health, 2015). Cancer is a systemic disease that directly affects the region of onset and can metastasize to other sites, causing a variety of complications and loss of progressive organ function. Malnutrition is a possible complication in

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patients with cancer and can be the first symptom to reveal the presence of the disease. Even before starting anti-cancer treatment, patients with cancer have high nutrient requirements due to increased metabolic rate (Planas, Fernández-Ortega & Abilés, 2011; Santarpia, Contaldo & Pasanisi, 2011). The prevalence of malnutrition among cancer patients has been estimated to range between 15% to 80% with the main symptoms being weight loss and asthenia of varying degrees (Von Haehling & Anker, 2012), while studies of hospitalised patients with cancer indicate that 56% to 76% of patients are either malnourished or at risk of being malnourished (Bauer, Capra & Ferguson, 2002). Weight loss is common in cancer patients particularly in head and neck cancer patients who develop dysphagia, dysgeusia and poor appetite that adversely influence their food intake. Reduced food intake with altered metabolic changes leads to the onset of cancer cachexia with the classic clinical presentation of wasting, anorexia and systemic inflammation (Santarpia *et al.,* 2011).

Malnutrition in cancer patients is a significant prognostic factor for increased mortality (Capra, Ferguson & Ried, 2001), delayed response to treatment (Norman *et al*.,2008) and a poorer quality of life (Lis *et al.,* 2012). Insufficient nutrients intake during cancer treatment can aggravate the pre-existing malnutrition to increase the risk of morbidity, hospitalisation period and cost of treatment (Correia & Waitzberg 2003; Pressoir, Desne & Berchery, 2010).

Nutritional screening should be performed at the time of the diagnosis, possibly before starting the specific anti-cancer treatments. It is the process of identifying patients at risk of malnutrition or those suspected of becoming at risk due to disease and/or treatment. Nutrition screening tools should be non-invasive, quick and simple to complete, be able to be implemented in any setting and be completed by non-technical staff, family or the patient (Bozzetti *et al.,* 2009). Malnutrition Screening Tool (MST) is recommended as the most accurate and applicable quick-and-easy tool readily available for use in the general hospital inpatient population (Neelemaat *et al*, 2011). This tool consist of questions that are predictive of malnutrition criteria which are body mass index (BMI), unintentional weight loss and changes in food intake due to poor appetite. MST has 93% sensitivity and specificity and is a valid tool for nutrition screening (Ferguson *et al*., 1999). Once, level of risk has been determined, further assessment of nutritional status by a professional is necessary. Subjective Global Assessment (SGA) proposes weight loss as a key indicator for malnutrition. It is a validated method of nutritional assessment based on the features of medical history and physical examination. It has been applied successfully as a method of assessing nutritional status and predicting outcomes in hospitalised patients, including patients with cancer (Shirodkar & Mohandas, 2005) It involves a short interview assessment of recent weight change, dietary intake, GI symptoms and functional impairment, and a physical examination.

Albumin is frequently used as an indicator of nutritional status. With its half-life of 20 days, its serum concentration reflects a patient's nutritional status over a sustained period of time. Hypo-albuminemia has been demonstrated to reflect protein-energy malnutrition and offers convincing evidence that the lower the serum albumin level, the higher the risk for post-operative complications and death. (Sullivan, Roberson & Bopp, 2005) In particular, pre-operative hypo-albuminemia is associated strongly with medical complications and mortality, while post-operative hypo-albuminemia (serum albumin ≤ 2.7 g/dL) with surgical

complications (Kao *et al*.,2012). There is emerging evidence that malnourished cancer patients are at higher risk for chemotherapy toxicity. Weight loss and hypo-albuminemia are associated with increased toxicity from chemotherapy (Arrieta *et al.,* 2010). Early nutrition intervention can improve health outcomes, morbidity and mortality, and reduce length of stay (LOS) in hospital patients (Santarpia *et al.,* 2011).

Underestimation of malnutrition remains a significant issue since early recognition of malnutrition may allow for early optimisation of nutrition intervention to support patients during treatment (Ottery, 1994). Malnutrition impairs the immune status and reduces the body's defense against infectious diseases (Alexandre, Gross-Goupil & Falssard, 2003). In light of these possible complications, malnutrition represents a poor prognostic factor especially for cancer patients who are going to receive anti-cancer treatments or ongoing treatment, and as such, should be prevented or detected as early as possible.

Information on malnutrition prevalence among cancer patients may benefit medical staff to develop a multidisciplinary team approach to manage patients with cancer and to achieve optimum clinical outcomes. There is limited information on the prevalence of malnutrition among cancer patients in Malaysia. Being the first National Cancer Institute (NCI) in Malaysia, NCI receives referrals from hospitals all over Malaysia. Hence, it is important to have baseline data in order to identify the patients being at risk of malnutrition and plan further intervention programs to prevent patients being more nutritionally depleted during treatment. This study aims to summarise nutrition screening and assessment tools available for use in hospitalised patients and provide a short discussion on malnutrition prevalence, association and correlation for early optimisation of nutrition intervention to support cancer patients during treatment.

METHODS

Selection of respondents

A cross-sectional study was conducted to determine prevalence of malnutrition among cancer respondents upon admission to the National Cancer Institute (NCI) in Putrajaya from August 2014 to January 2015. Eligible respondents for this study had to be 18-80 years old and able to communicate well in Malay or English. Respondents with communication problems, on ventilator support, suffering from mental harassment/dementia, psychiatric, pregnant or lactating within 6 months, experienced recurrent admissions and those who chose not to provide informed consent were excluded from this study. The sample size needed by this study was 81 patients calculated based on the formula by Azmi (2008) , $n= (Z_{1-\alpha})^2 P(1-P)/D^2$ with the value of P being equal to 23.1% that is the value for the prevalence of malnutrition in hospitals using SGA tools according to scores B and C (moderate malnutrition and severe malnutrition).

Ethical approval was obtained from the Medical Research and Ethics Committee, Ministry of Health (NMRR-14-656-21378). Additionally, permission to conduct the study was obtained from the directors of National Cancer Institute Putrajaya in Malaysia. Also, an informed consent letter approved by the Ethics Committee and signed by the respondents or authorised representative in the presence of a witness was obtained. A total of 97 respondents constituted the sample with 51 females (52.6%) and 46 males (47.4%). Respondents' socio-demographic data such as age, employment status, ethnicity, monthly income, marital status and educational level are listed in Table 1. Clinical characteristics of respondents including

Table 1. Background characteristics of respondents at the National Cancer Institute (NCI), Putrajaya

Characteristics	*n (%)*
Age (years)	
Mean	52.9 ±12.3
Range	19 - 79
Gender	
Male	46 (47.4)
Female	51 (52.6)
Ethnicity	
Malay	59 (60.8)
Chinese	20 (20.6)
Indian	15 (15.5)
Others	3 (3.1)
Marital status	
Married	82 (84.5)
Single	9 (9.3)
widow/widower	6 (6.2)
Occupation	
Government	25 (25.8)
Private	17 (17.5)
Self-working	7 (7.2)
Not working	42 (43.3)
Others	6 (6.2)
Household monthly income (RM)	
<1000	24 (24.7)
1000-2000	21 (21.6)
2001-3000	11 (11.3)
>3000	41 (42.3)
Body weight (kg)	
Mean	59.9 ±15.5
Body mass index (kg/m2)	
Mean	23.3 ±5.3
Underweight (< 18.5 kg/m2)	18 (18.9)
Normal (18.5 - 24.9 kg/m2)	44 (46.3)
Overweight (25 – 29.9 kg/m2)	22 (23.2)
Obese (≥ 30 kg/m2)	11 (11.6)

the presence of comorbid diseases, family history of cancer, route of feeding, type of treatment, type and stage of cancer were obtained from the computerised Hospital Information System (HIS) and through a face-to-face interview with respondents are given in Table 2.

Data collection

Malnutrition in this study was indicated as underweight with BMI <18.5kg/m2, MST ≥ 2 score, SGA score B or C and serum albumin <35g/L. Malnutrition status was determined using MST, SGA Score Sheet and serum albumin level. Subject's body weight and height were assessed using DETECTO weighing scale and stadiometer for body mass index (BMI, weight in kilograms divided by height in meters squared) calculation. The respondents' cut-off values for BMI classification refer to the World Health Organization (WHO) guidelines listed in Table 1. MST was used as a screening tool and was completed

Table 2. Medical characteristics of the respondents at National Cancer Institute (NCI), Putrajaya

Medical characteristics	*n*	*(%)*
Family history of cancer		
Yes	24	(25.5)
No	70	(74.5)
Pre-existing co-morbidities		
Yes	26	(26.8)
No	71	(73.2)
Type of cancer		
Lung	11	(11.3)
Nasopharynx	19	(19.6)
Breast	19	(19.6)
Cervix uteri	6	(6.2)
Colorectal	18	(18.6)
Prostate	1	(1.0)
Kidney	1	(1.0)
Hodgkin disease	1	(1.0)
Pancreas	1	(1.0)
Brain	5	(5.2)
Tongue	4	(4.1)
Ovary	1	(1.0)
Others	10	(10.3)
Stage of cancer		
1	6	(7.2)
2	11	(13.3)
3	22	(26.5)
4	44	(53.0)
Type of treatment		
No treatment	1	(1.0)
Chemotherapy	39	(40.2)
Radiotherapy	28	(28.9)
Chemotherapy and radiotherapy	16	(16.5)
Surgery	10	(10.3)
Others	3	(3.1)
Route of feeding		
Solid	74	(76.3)
Semi-solid	16	(16.5)
Liquid	4	(4.1)
Tube feeding	3	(3.1)

BMI - Body Mass Index ; For adult age <60years: Underweight: BMI≤18.5(Kg/m^2); Normal: BMI>18.5 ≤24.5(Kg/m^2); Overweight /Obese: BMI >25(Kg/m^2).

by the nurse upon admission. MST with a score ≥ 2 was categorised as at risk of malnutrition. SGA is a clinical tool to assess nutrition status of each subject by a dietitian according to standard guidelines. Using SGA Score Sheet, nutritional status was categorised into three groups: score A (well nourished), score B (mildly to moderately malnourished) and score C(severely malnourished) (Detsky *et al.*,1987). The biochemical parameter of serum albumin was retrieved from the medical report

upon respondents' admission to the ward. Serum albumin, along with BMI were used to determine the state of malnutrition among respondents The albumin level had to be below 34g/L and at least one of the following must be met: BMI indicates underweight or weight loss within the last 1 to 6 months (Sylvia, 2012). Dietary intake of respondents was assessed by means of a 24-h diet recall by a dietitian (Baranowski *et al.,* 2013). Respondents were asked for detailed descriptions and portions of foods and beverages consumed; recipes were collected whenever foods consumed were not available in the Malaysian food database. The food intakes (i.e. from the portion sizes recorded on the food recall form) were converted to food weights and calculated based on Suzana *et al.* (2009) and Tee *et al.* (1997). The recommended nutrient intake for Malaysians (RNI) was used as the benchmark to assess the adequacy of energy intake and the distribution of energy from macronutrients such as carbohydrate and protein (National Coordinating Committee on Food and Nutrition, 2005).

Data analysis

All data were analysed using the IBM SPSS Statistic 22.0, IBM Corp released 2010 and IBM Statistic for windows, version 22.0 (Armonk, NY: IBM Corp). Descriptive statistics including range, means, median, standard deviation, interquartile range and frequency were used to present subject's demography information, patient's daily dietary intake, disease characteristics, and overall state of malnutrition via serum albumin level, MST and SGA Score, and state of malnutrition via gender, ethnic, type and stage of cancer. Pearson's and Spearman's were used to determine correlation between SGA score with patient's daily energy and protein intake. The level of significance was set at $P < 0.05$ for all analysis.

RESULTS

A total of 100 respondents, who were on their first admission to the ward in the National Cancer Institute, after confirmed diagnosis of cancer, were approached; 97 respondents completed the study (97% response rate). Of the 3 respondents who were excluded, one was a repeat patient and two had incomplete dietary data. Socio-demographics and disease characteristics of the study groups are given in Table 1. The mean age was 52.9±12.3 years (range: 19 to 79 years). Classification by ethnicity showed that the majority of patients were Malay (60.8%) followed by Chinese (20.6%), Indian (15.5%) and others (3.1%). The baseline characteristics showed that 43.3% respondents were not working, 59% of the respondents' income was less than RM3000 per month and 82% were married. The BMI characteristics of the study groups are given in Table 1. The mean BMI of respondents was 23.3±5.3 and mean weight 59.9±15.5; 18 of the 97 respondents were underweight.

The medical characteristics of respondents are found in Table 2. Of the 97 respondents, 26.8% had pre-existing co-morbidities and 25% had a family history of cancer. Respondents had different types of cancer: nasopharyngeal (n=19; 19.6%), breast (n=19; 19.6%), colorectal (n=18; 18.6%), lung (n=11; 11.3%), cervix (n=6; 6.2%), brain (n=5; 5.2%), tongue (n=4; 4.1%) and others (n= 15; 15.4%) had prostate, kidney, ovary, Hodgkin disease and pancreas cancers. The proportion of respondents diagnosed with cancer at stage 1 and 2 were 7.2 % and 13.3%, respectively; 26.5% participants presented with late locally advanced cancer (i.e. Stage 3) and 53 % were in metastasised stage of the disease (i.e. Stage 4). About 40.2% of the respondents were on chemotherapy, 28.9% radiotherapy and 16.5% both chemotherapy and radiotherapy treatment. Almost all of respondents could take solid

Table 3. Nutritional status according to MST, SGA and serum albumin of the respondents at National Cancer Institute, Putrajaya

Background characteristics	*n (%)*
MST group	
Mean	1.9 ±1.8
Not at risk of malnutrition	38.1
At risk of malnutrition	61.9
SGA group	
Mean	6.1±5.7
Well nourished (SGA A)	56.5
Mild to moderately (SGA B)	42.4
Severely malnourished (SGA C)	1.1
Serum albumin (mmol/l)	
Mean	36.0±6.0
High albumin level	10.3
Normal albumin level	56.7
Low albumin level	33

SGA - Subjective Global Assessment; Well nourished: Scoring classification A; Mild to moderately: Scoring classification B; Severely malnourished: Scoring classification C.
MST - Malnutrition Screening Tool : Not At Risk: MST 0 or 1; At risk: MST 2 or more
Serum Albumin - normal range is 3.4 to 5.4 g/dL

food while 4.1% were on a liquid diet and 3.1% on tube feeding.

The prevalence of malnutrition was determined by using MST, SGA Score Sheet and serum albumin level as shown in Table 3. Based on MST, 61.9% of the respondents were at risk of malnutrition and 38.1% not at risk of malnutrition. The mean MST score was 1.9±1.8. About 36.7% of the respondents were at risk of malnutrition under age group 56-65 years and 28.3% for the age group 46-55 years. The majority (51.7%) of respondents at risk of malnutrition were women. For ethnicity, 51.7% of Malays were at risk of malnutrition, followed by Chinese (23.3%) and Indian (21.7%) according to MST. Most of the respondents at risk of malnutrition had been diagnosed with NPC (25%) followed by breast cancer (16.7%) and colorectal cancer (15%). In terms of malnutrition status at the various stages of cancer, 56.9% and 21.6% of the respondents were at risk of malnutrition at Stage 4 and Stage 3 cancer, respectively.

The SGA score sheet revealed that 56.5 % of all respondents were well nourished (Stage A), 42.4% were moderately malnourished (Stage B) and 1.1% were severely malnourished (Stage C). The mean SGA score was 6.1±5.7. About 35.9% and 25.6% of respondents who were malnourished were in the age group of 56-65 years and 46-55 years respectively. According to SGA, 56.4 % of malnourished respondents were men. Most of the moderately malnourished respondents were diagnosed with NPC (30.7 %) and lung cancer (20.5 %). By ethnicity, about 53.9% of malnourished patients were Malay, followed by Indian (23.1 %) and Chinese (17.9 %). The majority of malnourished respondents (69.7%) were at Stage 4.

More than half of the respondents had normal albumin while 33% had low albumin levels.. The mean serum albumin level for all respondents was 36.0±6.0. Of

Table 4. Association between BMI and SGA, type of cancer and SGA

Variables	*n*	*SGA A n (%)*	*SGA B n (%)*	*SGA C n (%)*	*p-value*[a]
BMI					<0.001
Underweight (< 18.5 kg/m2)	18	5 (27.8)	12 (66.7)	1 (5.6)	
Normal (18.5 - 24.9 kg/m2)	41	20 (48.8)	21 (51.2)	0 (0)	
Overweight (25-29.9 kg/m2)	20	18 (90)	2 (10)	0 (0)	
Obese (≥ 30 kg/m2)	11	8 (72.2)	3 (27.3)	0 (0)	
Type of Cancer					<0.001
Lung	11	3 (27.3)	8 (72.7)	0 (0)	
Nasopharynx	15	4 (25)	12 (75)	0 (0)	
Breast	19	16 (84.2)	3 (15.8)	0 (0)	
Cervix uteri	6	5 (83.3)	1 (16.7)	0 (0)	
Colorectal	18	14 (77.8)	3 (16.7)	0 (0)	
Prostate	1	0 (0)	1 (100)	0 (0)	
Kidney	1	1 (100)	1 (100)	0 (0)	
Hodgkin disease	1	1 (100)	0 (0)	0 (0)	
Pancreas	1	1 (100)	0 (0)	0 (0)	
Brain	5	4 (80)	1 (20)	0 (0)	
Tongue	4	1 (25)	3 (75)	0 (0)	
Ovary	1	0 (0)	1 (100)	0 (0)	
Others	9	3 (33.3)	6 (66.7)	0 (0)	

Note: [a]Fisher's exact test.
SGA - Subjective Global Assessment; Well nourished: Scoring classification A; Mild to moderately: Scoring classification B; Severely malnourished: Scoring classification C.

the respondents with low albumin levels, 43.8 % were in the age group 56-55 years and 28.1 % in the age group 46-55 years old. In terms of gender, of those with low albumin levels, the majority were men (53.1 %) For ethnicity, 56.2 % were Malays, followed by Indian (21.9%), Chinese (18.8 %) and others (3.1 %). Most of the patients with low albumin level were diagnosed with colorectal cancer (21.9 %) followed by NPC (15.6 %), lung cancer (15.6%), and others (15.6 %). Of those with low albumin levels, 77.8 % were at Stage 4 cancer followed by 14.8 % at Stage 3. The data also showed that most of the patients who were malnourished were undergoing chemotherapy based on SGA (43.6%), MST (38.3%) and by serum albumin level (31.3%).

Although low BMI and malnutrition are associated, 44 out of 95 of the respondents in the normal or overweight/ obese ranges in this study were at risk of malnutrition based on MST. One respondent was severely malnourished and was underweight according to the SGA score. Of the respondents with low albumin levels, 31 were overweight/ obese.

Based on the data collected, no significant association was found between MST score and age, gender, ethnic, BMI, type and stage of cancer. However, there was a significant association between SGA score with BMI and type of cancer as shown in Table 4. There was also a significant association between albumin level with age, BMI and stage of cancer (Table 5). The

Table 5. Association between age and albumin, BMI and albumin, stage of cancer and albumin

Variables	*n*	*Low albumin n (%)*	*Normal albumin n (%)*	*p-value*[a]
Age				0.023
18-25	3	1 (14.3)	2 (66.7)	
26-35	7	1 (14.3)	6 (66.7)	
36-45	15	4 (26.7)	11 (73.3)	
46-55	25	9 (36)	16 (64)	
56-65	36	14 (38.9)	22 (61)	
>65	11	3 (27.3)	8 (72.7)	
BMI				0.001
Underweight (< 18.5 kg/m2)	18	12 (66.7)	6 (33.3)	
Normal (18.5 - 24.9 kg/m2)	44	16 (36.4)	28 (63.6)	
Overweight (25-29.9 kg/m2)	22	2 (9.1)	20 (90.9)	
Obese (≥ 30 kg/m2)	11	1 (9.1)	10 (90.9)	
Stage of cancer				
1	6	1 (16.7)	5 (83.3)	0.034
2	11	1 (9.1)	10 (90.9)	
3	22	4 (18.2)	18 (81.8)	
4	44	21 (47.7)	23 (52.3)	

Note: [a]Fisher's exact test.
Serum Albumin - normal range is 3.4 to 5.4 g/dL

Spearman's correlation showed a negative correlation between BMI with SGA Score, r=-0.497, n=90, p=<0.001 and a positive correlation between BMI and albumin level, r=0.458, n=85, *p*=<0.001.

One day energy and protein intake data are summarised in Table 6. The mean of energy intake was 1463±577 kcal and protein intake was 54±22 g. The total energy and protein intake from breakfast, lunch and dinner were 349±186 kcal and 10.5±6.2 g protein, 410±189 kcal and 17.7g±9.0 g protein, 375 kcal±178 kcal and 15.8g±8.7 g protein, respectively. There was no intake for morning tea but less than 100 kcal from supper. The median energy and protein intake during afternoon tea was 131±243 kcal and 2.6±8.0 g protein. Using Pearson's correlation, there was a negative correlation between daily energy intake with SGA score, r=-0.593, n=92, *p*=<0.001 which suggests a moderate correlation. Spearman's correlation showed a negative correlation between daily protein intake with SGA Score, r=-0.412, n=92, *p*=<0.001.

DISCUSSION

Malnutrition is common in patients with cancer; it is, however, often overlooked in clinical settings (Khalid *et al.,* 2007). Malnutrition among respondents can be observed from both screening and assessment tools. This study findings are supported by a local study of Kavitha *et al.* (2014) where one-third of patients with cancer from the East Coast of Peninsular Malaysia were malnourished at the time of diagnosis, more than one-third undernourished and two thirds anaemic.

Most of the respondents of this study were married. However, a high 43.3% of respondents were not working and had

Table 6. Nutritional assessmentofcancer patients at NCI

	Mean (SD)	*Median(IQR)*
Diet intake for a day		
Energy (kcal/day)	1462.7(577.4)	
Protein (g/day)	53.9(22.1)	
Diet intake for breakfast		
Energy (kcal)	349.0(186.8)	
Protein (g)	10.5(6.2)	
Diet intake for morning tea		
Energy (kcal)		0.0(149.0)
Protein (g)		0.0(4.4)
Diet intake for lunch		
Energy (kcal)	409.8(188.6)	
Protein (g)	17.7(9.0)	
Diet intake for afternoon tea		
Energy (kcal)		131.0(242.5)
Protein (g)		2.6(8.0)
Diet intake for dinner		
Energy (kcal)	375.0(178.1)	
Protein (g)	15.8(8.7)	
Diet intake for supper		
Energy (kcal)	87.7(106.8)	
Protein (g)		0.0(5.2)

Recommended Nutrient Intakes(RNI) for Malaysia – Adult (19-65 years) ; Men :2010-2240kcal/day; Women: 1780-2000kcal/day .

household incomes of less than RM3000 per month. The unemployed respondents were mostly women. Lack of access to a nutritious, balanced diet may have contributed to the high rate of malnutrition among respondents.

Though the malnutrition rate was high in this study, the mean BMI was still within the normal range partly because 30% of the respondents were breast and colorectal cancer cases. The majority of these patients, especially breast cancer cases undergoing radiotherapy did not have nutritional issues and were able to take food orally as the treatment does not cause nutritional side effects as much as head and neck cancer treatments. This is supported by the study of Shirodkar & Mohandas (2005) where the patients with breast cancer were found to have better nutrition, fewer complications and shorter hospital stay than patients with cancer of the esophagus. Sarhill *et al.* (2003) reported similar findings in their study on 346 advanced cancer patients where 87% had normal or high BMIs. However, the same study found that some patients suffered severe post-illness weight loss though most of them had normal BMI. They explained this phenonmena by suggesting the existence of pre-illness obesity. Therefore, BMI in itself is not a sensitive parameter to analyse nutritional status as unintentional weight loss could occur among overweight or obese cancer patients.

Nutritional assessment using SGA showed the mean SGA score to be 6.1±5.7 which was in the mildly malnourished category. This finding was reflected by 43.5% of the respondents being mildly to severely malnourished. The middle age group (i.e. 46-55 years old) and older age

group (i.e. 56-65 years old) had a higher rate of malnutrition for both MST and SGA compared to the younger age group (i.e. 17- 45 years old). Elderly patients are particularly prone to inadequate nutritional intake due to concomitant chronic diseases, polypharmacy, decreased mobility, social changes as well as age related physiological changes **(**Beck, Ovesen & Osler, 1999)

In this study, respondents with Stage 3 and Stage 4 cancer, not considering any specific type of cancer, contributed a higher number of respondents being at risk of malnutrition and mildly to moderately malnourished. This was supported by a large study of 14,972 Korean cancer patients, the proportion of patients with high risk for malnutrition as defined by BMI, serum albumin, total lymphocyte count and dietary intake, increased with cancer stage (Wie *et al.,* 2010). Similarly, in the SCReening the Nutritional Status in Oncology (SCRINIO) study of 1000 oncology outpatients in Italy, weight loss was higher in patients with more advanced stage of disease and compromised performance status (Bozzetti *et al.,* 2009). Advanced tumour stage, a consequence of disease progression, is a well-established poor prognostic factor (Kanesvaran *et al.,* 2011; Soubeyran *et al*., 2012).

The four most common cancer patients who developed mildly to moderately malnourished status or at risk of malnutrition or had a low serum albumin level were NPC, lung cancer, breast cancer and colorectal cancer. These findings are consistent with other studies which estimated that about 20% of head and neck and gastrointestinal cancer patients die due to malnutrition than from cancer *per se* (Ottery, 1994; Leuenberger, Kurmann & Stanga, 2010).

Most of the patients in NCI were undergoing treatment with the majority of the respondents (95.9%) being on chemotherapy, chemo-radiation therapy, radiotherapy or surgery. A high prevalence of malnutrition in patients with cancer undergoing treatment is not surprising as cancer treatments have implications on food intake of patients due to associated side effects such as nausea, vomiting, loss of appetite, taste and smell alterations and anorexia (Lucia *et al.,* 2012). Cancer treatments may develop or aggravate the anorexia, and without adequate nutritional support, may trigger a series of catabolic changes that lead to weight loss and early cancer cachexia (Lucia *et al.*, 2012).

Another nutritional assessment tool used was serum albumin level. Thirty-three percent of the respondents were reported to have low serum albumin level which was lower than 35g/dL; the highest number of respondents (52%) was in the normal BMI category followed by 38.7% being underweight and 9.7% being overweight and obese. The specific type of cancer with low albumin level was highest in colorectal followed by NPC, lung, tongue and breast cancer. The lowest albumin level reported was 22g/dL. The possible reason of hypo-albuminemia among colorectal cancer patients may be due to mal-absorption of nutrients from the food consumed.

In this study, dietary intake was also assessed and the results showed that overall daily energy and protein intake of the respondents was between 885 kcal to 2040 kcal and 31.8 gto 76 g protein with most of the diet intake bring during the three main meals of breakfast, lunch and dinner. The mean energy intake was 1463 kcal ± 577 kcal. This result was lower than the recommended energy intake based on RNI for men and women of 19 to 65 years old in Malaysia which is 1780 kcal to 2460 kcal. However, the mean protein intake of 54g±22 g was within the recommendation of RNI for the same age group of men and women (National Coordinating Committee on Food and Nutrition, 2005). It was observed that respondents had better

appetite during the day as the mean energy at breakfast and lunch of 759 kcal and protein 28.2 g compared to later in the day (afternoon tea, dinner and supper) at 594 kcal and 18.4 g protein. These results can be used as baseline data to encourage patients to increase food or drinks intake during the later part of the day. Patients may be able to comply with dietary recommendations better during daytime.

This study has several limitations which may need to be addressed. First, the patient-generated-subjective global assessment (PG-SGA) may be preferred over SGA for a study of this nature. PG-SGA was adapted from the SGA and developed specifically for patients with cancer (Ottery, 1994). It includes additional questions on the presence of nutritional symptoms and short-term weight loss. It is designed to enable components of the medical history to be completed by the patient using a check box format. However, due to the simplicity of SGA and the fact that it is less time-consuming, SGA was used in this study. Second, a larger sample size may be more appropriate to represent the population. But the sample serves as good baseline data for our institution to develop further interventional studies in the future to address malnutrition in cancer patients.

CONCLUSION

This study provides baseline data on the prevalence of malnutrition among hospitalised cancer patients in NCI. The majority of patients at Stages 3 and 4, regardless of cancer type, showed an increased risk of malnutrition. Patients with higher risks of malnutrition may face complications during treatment. Appropriate measures should be taken to reduce malnutrition among cancer patients at the National Cancer Institute.

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