MALNUTRITION AMONG CANCER PATIENTS: ROLE OF SOCIAL SUPPORT

Lau Swee Sing and Divya Vanoh*

Dietetics Programme, School of Health Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kubang Kerian, Kelantan

*Corresponding author: Divya Vanoh
Email: divyavanoh@usm.my

ABSTRACT

*Malnutrition is linked with poorer outcomes following cancer treatment. This study determined the association between marital status, nutritional status and social support among cancer patients. This was a **cross-sectional study** involving 82 cancer patients receiving both outpatient and inpatient cancer treatment in Hospital Universiti Sains Malaysia (HUSM). Parameters investigated were socio-demography, nutritional status and social support. Nutritional status was assessed using the Patient Generated-Subjective Global Assessment (PG-SGA) while social support using Multidimensional Perceived Social Support Scales (MSPSS). Chi-Square or Fisher Exact test had been used for analysing the association between the variables. The prevalence of malnutrition assessed using PG-SGA was 69.5%. A total of 61% of the cancer patients experienced weight loss within a month. There was a statistically significant association between malnutrition and social support (p<0.05). A total of 63.6% of the patients with high social support from friends reported to have weight loss while 52.6% of those with moderate social support had weight gain. Good social support will determine good quality of life among cancer patients, however there were several other factors such as stage of cancer, side effect of cancer treatment and poor dietary intake that determine the nutritional status of cancer patient. Thus, holistic approach involving multidisciplinary team must be taken for monitoring and improving health status of cancer patients.*

Keywords: Cancer, weight status, marital status, social support, malnutrition, nutritional status

INTRODUCTION

Cancer is one of the prominent non-communicable diseases and responsible for more than 8 million deaths each year worldwide. It is expected to increase to 22 million people annually by 2030, with more than 60% of new patients from Africa and Central and South Asia[1]. Cancer is the rapid formation of abnormal cells that grow beyond their usual boundaries, can invade adjoining parts of the body and spread to other organs. The latter process is referred to as metastasis and is the major cause of death in cancer.[2]

The GLOBOCAN report issued by the International Agency for Research on Cancer (IARC) had reported 18.1 million new cancer cases and 9.6 million cancer related mortality in year 2018 across 20 world regions[3]. In Malaysia, cancer is the fourth leading cause of death comprising of 12.6% of deaths from government hospital and 26.7% from private hospital[4]. According to the Malaysian National Registry Report 2012-2016 published in 2019, a total of 115,238 new cancer cases were diagnosed in Malaysia with 55.3% female and 44.7% male[4].

Malnutrition, anorexia, and weight loss are common in cancer patients, even at their first visit to a medical oncology center[5]. Malnutrition in cancer is a result of an inadequate nutritional intake that leads to depletion of body stores of fat and lean mass, and ultimately result in reduced physical function as the body produces cytokines with an effort to fight against cancer[6]. Many cancer survivors have unintentional weight loss (marker of undernutrition) and associate their weight loss with negative outcomes[7]. The scored Patient Generated Subjective Global Assessment (PG-SGA) is an easy-to-use nutrition assessment tool that allows quick identification and prioritization of malnutrition in hospitalized cancer patients[8].

In addition, cancer patients who are single or widowed, are at significantly higher risk of suffering from metastasis and mortality due to reduced adherence to cancer treatment as compared to those who are married. Marriage has an important role in cancer identification, compliance to treatment and survival[9]. Marriage which symbolizes social support is a vital element to motivate patients for practicing positive health related behavior especially in receiving or continuing treatment, and proper management of emotional distress[10]. Thus, a study is conducted to determine the association between weight status, marital status and social support among cancer patients in Hospital Universiti Sains Malaysia (HUSM).

METHODS

The research design of this study was cross sectional study as it can usually be conducted relatively faster at a lower cost since no long periods of follow-up was required. The outcome and exposures in the study participants were measured at the same time. The participants

were selected based on the inclusion and exclusion criteria for the study. In this study, a group of cancer patients were assessed to determine the marital status, weight status and social support. Ethical approval had been obtained from the Human Research Ethics Committee and informed consent were given by each participant at the beginning of the study. This study was conducted in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki).

The study was conducted from January 2020 to March 2020 in both the outpatient and inpatient settings. The outpatient setting included the Oncology Clinic, Surgery Clinic, and Outpatient Radiation Clinic. Meanwhile, inpatient setting consisted of Gynaecology ward, Oncology & Haematological ward, Haematology wards, and Otorhinolaryngology ward. The subjects of this study were recruited using convenience sampling method.

Subject Criteria
The inclusion criteria for this study were patients diagnosed with cancer either newly diagnosed or establish malignancy, aged $\geq$ 18 years old who were admitted or referred for cancer, patients with or without cancer related treatment and Karnofsky Performance Status Scale score of $\geq$ 50%. On the other hand, the exclusion criteria were cancer patients who were bedridden or who were undergoing hemodialysis, and patients with pre-existing gastroenterological disease such as Crohn's disease, inflammatory bowel disease, and ulcerative colitis as their malnutrition status may be affected by their pre-existing disease condition. Pregnant cancer mother, cancer patients who were receiving hematopoietic cell transplant, or cancer patient who were on ventilation in ICU setting were also excluded.

Sample Size Estimation
Sample size was calculated to determine the amount of sample needed to obtain reliable and valid average results for nutritional status assessment through PG-SGA, social support adequacy through MSPSS and weight status from a population of study on cancer patient. The sample size was calculated using formula from Daniel, 1999[11].

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

n= estimated sample size, Z= Z statistic for a level of confidence, P= expected prevalence of proportion, and d= precision.

For this research, the precision was set at 10% with 95% confidence interval, and the z-score value of 1.96. According to study using PG-SGA, the prevalence of malnutrition among cancer patients at a university hospital in Brazil was 77%[12]. In this study, the expected prevalence of malnutrition in cancer patients was set at 77%.

The sample size was calculated as below:
$$n = \frac{1.96^2 \, 0.77(1-0.77)}{0.1^2} = 68.03 \approx 68 \text{ samples}$$
Sample size = 68 + 20% of drop out $\approx$ 82 subjects.

With estimated drop-out rate of 20%, total required sample size for this study was 82 subjects.

Research Tools and Instruments
The socio-demography variables included in this study were age, marital status, ethnicity, education level and occupation. Medical history included were the other co-morbidities besides cancer such as diabetes mellitus, heart diseases, stroke or hypertension. Clinical data were date of admission (DOA), medical diagnosis, duration of diagnosis, type of cancer, and treatment received.

For anthropometry data, weight were taken using digital weighing scale (Tanita glass digital bathroom scale HD-384 (Japan). Subjects were asked to empty their pockets, remove their shoes and stand on the weighing scale with head straight facing in front. Weight was taken twice at the nearest 0.1kg for more accurate result. Weight loss or gain was based on the subjects` weight for the past 3 months. For those who were unable to stand without support, weight measurement was estimated using the formula below[13].

Weight (men) = (1.10 x Knee Height) + 3.07 MUAC – 75.81
Weight (women) = (1.01 x Knee Height) + 2.81 MUAC – 66.04

Height of the subjects were measured by the researcher using SECA Bodymeter 206 (Germany). Subjects were required to remove their shoes or cap, stand straight with face straight to the front and with arms hanging at the side of the body. Height was taken twice to the nearest 0.1cm for a more accurate result. For subjects with limited movement, knee height was measured twice. Knee height value was then applied into Suzana & Ng (2003) formula as shown below[14]:

Men   : Height = 69.38 + (1.924 x KH)
Women: Height = 50.25 + (2.225 x KH)

Body Mass Index (BMI) was a measure of weight adjusted for height, calculated based on weight in kilograms divided by the square of height in meters (kg/m^2)[15]. BMI was a simple measure to define the adiposity of a person as underweight, normal weight, overweight, or obese. The cut-off points for each BMI categories were reported based on World Health Organization criteria.

Weight status comprised of weight loss, no weight changes or weight gain. In this study, the respondent's usual weight was the weight for the past one month. Weight history or the previous weight was either reported by the subject themselves or their caregivers or as stated in the medical folder. Percentage of weight loss was calculated.

Karnofsky Performance Status Scale

Karnofsky Performance Status Scale represented a respondent's ability in performing normal activity, doing active work and the need for assistance[16]. The numerical scale of performance status was rated from 0 to 100. The lower the Karnofsky score, the worse the likelihood of survival. In this study, cancer patients who scored > 50% in the Karnofsky Performance Status Scale were selected.

Scored Patient Generated Subject Global Assessment (PG-SGA)

Scored PG-SGA consisted of two sections[17]. The first section consisted of four parts of patient-generated historical components including weight history, food intake in the past month, symptoms that affected eating habits, as well as activities and functions over the past month. Meanwhile, the second section consisted mainly on weight loss score, disease and its relation with nutritional requirements, metabolic demand and physical exam which required to be completed by professional workers such as doctors, nurses, dietitian or therapist.

For the first section of PGSGA regarding the weight loss scoring, weight for the past one month was used. Weight for the past two weeks care professionals such as nurses, doctors, or support staffs. It contained 12 items with Likert scale of 1 to 7 ranging from very strongly disagree to very strongly agree. The items in each domain were; family (3,4,8 & 11), friends (6,7,9 & 12) and significant others (1,2 ,5 & 10).

The scoring for each subscale were done by obtaining the mean value for the scores of each was considered as moderate support whereas a score from 5.1 to 7 symbolized high support[19].

Statistical Analysis

All collected data were analyzed using Statistical Package for Social Sciences (SPSS) version 25.0. Statistical significance was set at $p < 0.05$ (two-tailed) with 95% confidence interval. Normality of data was tested using Kolmogrov-Smirnov test. General characteristics were summarized using descriptive statistics. The data were presented using mean and standard deviation (SD) for continuous variables that was normally distributed. Median and interquartile range (IQR) were used to present data which was not normally distributed. For categorical data, frequency and percentage (%) were used. The association between marital status (categorical

was investigated to determine the severity of weight loss. Respondents were required to choose any options that best described their current eating habits and the severity of functional limitations was considered.

Meanwhile in Section 2 of PG-SGA, physical examination were conducted including muscle status, fat stores and fluid status. Rating in this category was not additive and often, muscle deficit or loss would take precedence over fat loss or fluid excess and categorized into no deficits (0 point), mild deficits (1 point), moderate deficit (2 points) and severe deficit (3 points). Besides, the score for metabolic stress was additive. A patient who had fever of more than 38.8°C for more than 72 hours, scored four points and extra two points will be added to this score if they were on more than 10mg of prednisone chronically. The diagnosis of the patient were determined by the doctors. The sum of the four questions in Section 1 were added with the scores of Section 2 for the grand total and divided into three categories namely stage A (well-nourished), stage B (moderate or at risk of malnourished) and stage C (severely malnourished) to determine malnutrition status.

Multidimensional Scale of Perceived Social Support (MSPSS)

Malay version of MSPSS was a self-administered scale that was useful in the assessment of social support adequacy[18]. The Malay version of MSPSS had good internal consistency (Cronbach alpha`s=0.89). It consisted of three domains which were family, friends, and significant others. Significant others referred to the health

respective item. For example, total score of the significant other subscales was obtained by adding the scores of items 1, 2, 5 and 10 and divided by 4. A total scale was calculated by summing all the 12 items and divided by 12. Any mean scale score ranging from 1 to 2.9 indicated low support, score of 3 to 5

variable), social support (categorical variable) and malnutrition according to PG-SGA classification (categorical variable) was tested using Pearson's Chi-Square if expected count <5 was less than 20% of the cells or Fisher's Exact if the expected count <5 was more than 20% of the cells.

RESULTS

The sociodemographic data of 82 cancer patients were shown in Table 1. About 72% of the subjects were treated as inpatient while 28% as outpatient. The mean age of the cancer patients were 51.7 years old with standard deviation of 16.0. Most of the respondents were women (61%), of Malay ethnicity (90.2%), married (70.7%) and received secondary education

(56.1%). A total of 40.2% of the patients were housewife.

Table 1 Sociodemographic data of respondents with cancer in HUSM (presented as n (%) or mean $\pm$SD)

	Number (N=82)	Percentage (%)
Age (in years) (Mean $\pm$ SD)	51.7 $\pm$ 16.0	
Hospitalization setting		
Inpatient	59	72.0
Outpatient	23	28.0
Gender		
Men	32	39.0
Women	50	61.0
Race		
Malay	74	90.2
Chinese	5	6.1
Siamese	3	3.7
Marital Status		
Married	58	70.7
Single	10	12.2
Divorced/ widowed	14	17.1
Educational Level		
No formal education	4	4.9
Primary school	11	13.4
Secondary school	46	56.1
College / University	21	25.6
Employment Status		
Not working	11	13.4
Self-employed	8	9.8
Working (Private/Government)	14	17.1
Housewife	33	40.2
Pensioner	16	19.5

Medical history and current medical problems of cancer respondents in HUSM were reported in Table 2. A total of 41.5% of the cancer patients had comorbidities such as Type II diabetes mellitus, chronic kidney disease, hypertension, ischemic heart disease and hyperlipidemia.

A total of 29 cancer patients (35.4%) had reproductive cancer such as breast cancer, ovarian cancer, cervix cancer and prostate cancer and 24 patients (29.3%) were undergoing chemotherapy (Table 4).

Table 3 showed nutritional status of the cancer respondents. There was a significant association between weight status and gender, tested using Pearson's Chi-Square Test (x^2 = 10.615, p value = 0.004). More women (68%) as compared to men (50%) were reported to have weight loss. There was no statistically significant association between marital status and weight status, tested using Fisher's Exact test (x^2 = 3.512, p-value =0.441)

There was a statistically significant association between PGSGA classification and social support, tested using Fisher's Exact test (x^2 = 5.913, p-value = 0.039). Higher prevalence of severe malnourishment was reported in the moderate support group (37.5%) as compared to the high support group (16.2%) (Table 4).

Significant association was only observed between weight status and social support from friends. A total of 63.6% of the subjects with high social support from friends and 100% of those with low social support from friends experienced weight loss. (Table 5)

Table 2a Medical history and current medical problem of cancer respondents (presented as n (%))

	Frequency (N= 82)	Percentage (%)
Family History of Cancer		
Absent	57	69.5
Present	25	30.5
Medical History		
None	48	58.6
HPT	13	15.9
T2DM	5	6.1
T2DM, HPT	5	6.1
HPT, HPL	4	4.9
T2DM, IHD	1	1.2
T2DM, HPL	1	1.2

Table 2b Medical history and current medical problem of cancer respondents (presented as n (%))

HPT, IHD	1	1.2
T2DM, HPT, IHD	1	1.2
T2DM, HPT, HPL	1	1.2
CKD STAGE III	1	1.2
HPT, HPL, IHD, CKD Stage III	1	1.2
Type of Cancer		
Sarcoma	4	4.9
Carcinoma	10	12.1
Hematologic cancer	19	23.2
Gastrointestinal cancer	9	11.0
Reproductive cancer	29	35.4
Head and neck cancer	4	4.9
Respiratory cancer	5	6.1
Renal cancer	1	1.2
Urinary cancer	1	1.2
Treatment Received		
None	5	6.1
Radiotherapy	4	4.9
Chemotherapy	24	29.3
Radiotherapy & Chemotherapy	10	12.2
Surgery	8	9.8
Radiotherapy & Surgery	5	6.1
Chemotherapy & Surgery	14	17.1
Chemotherapy, Radiotherapy & Surgery	12	14.6

T2DM: type 2 diabetes mellitus; HPT: hypertension; HPL: hyperlipidemia; IHD: ischemic heart disease, CKD: chronic kidney disease

Table 3a Nutritional status analysis of cancer respondents in HUSM (presented as n(%) and median $\pm$IQR)

	Men (n=32) n (%)	Women (n=50) n (%)	Total (N=82) n (%)	p-value
Weight (kg)	59.8 ± 15.1	55.4 ± 21.9	-	0.165[a]
Median $\pm$ IQR				
Height (cm)	167.3 ± 10.8	155.0 ± 11.3	-	0.01[a]
Median $\pm$ IQR				
BMI (kgm^{-2})	21.4 ± 4.6	23.1 ± 7.4	-	0.122[a]
Median $\pm$ IQR				
BMI Category				
Underweight	4 (12.5)	9 (18.0)	13 (15.9)	0.060[c]
Normal	21 (65.6)	21 (42.0)	42 (51.2)	
Overweight	4 (12.5)	12 (24.0)	16 (19.5)	
Obese Class I	3 (9.4)	1 (2.0)	4 (4.9)	
Obese Class II	0 (0.0)	5 (10.0)	5 (6.1)	
Obese Class III	0 (0.0)	2 (4.0)	2 (2.4)	
Weight Status				
Weight loss	16 (50.0)	34 (68.0)	50 (61.0)	0.004[b]
No changes	1 (3.1)	8 (16.0)	9 (11.0)	
Weight gain	15 (46.9)	8 (16.0)	23 (28.0)	

Table 3a Nutritional status analysis of cancer respondents in HUSM (presented as n(%) and median $\pm$IQR)

PGSGA Classification				
Stage A (well-nourished)	8 (25.0)	17 (34.0)	25 (30.5)	0.685[b]
Stage B (moderate/ at risk of malnourished)	18 (56.3)	24 (48.0)	42 (51.2)	
Stage C (severely malnourished)	6 (18.7)	9 (18.0)	15 (18.3)	

[a] Tested using Mann Whitney Test; [b] Tested using Pearson's Chi Square; [c] Tested using Fisher's Exact Test
Abbreviation: BMI: body mass index; PG-SGA: Patient Generation-Subjective Global Assessment; IQR: interquartile range

Table 4 Association between weight status, malnutrition and social support among cancer patients in HUSM [presented as n(%)]

	Social Support n (%)			x^2(df)	p value
	Low support (n=0)	Moderate support (n=8)	High support (n=74)		
PGSGA Classification				5.913(2)	0.039*
Stage A (well-nourished)	0 (0.0)	4 (50.0)	21 (28.4)		
Stage B (moderate/ at risk of malnourished)	0 (0.0)	1 (12.5)	41 (55.4)		
Stage C (severely malnourished)	0 (0.0)	3 (37.5)	12 (16.2)		
Weight Status				0.892(2)	0.647
Weight loss	0 (0.0)	4 (50.0)	46 (62.2)		
No changes	0 (0.0)	1 (12.5)	8 (10.8)		
Weight gain	0 (0.0)	3 (37.5)	20 (27.0)		

*Tested using Fisher's Exact test

DISCUSSION

Weight Status among Cancer Patients

Weight loss and nutritional problems were often associated with cancer. Findings of this study revealed that most of the female cancer patients (68%) experienced weight loss as compared to male. Greater weight loss among female cancer patients (55.9%) can be due to lesser food intake which further accelerated weight loss. Weight loss was high among 61% of the study population, 28% presented with weight gain while others had no changes in weight. Patients with reproductive cancer, hematologic cancer, and carcinoma such as breast invasive carcinoma, endometrial carcinoma, advanced sigmoid adenocarcinoma, gastric adenocarcinoma, papillary thyroid, cervical carcinoma experienced weight loss with 68.4%, 50% and 72.4% respectively. Weight loss among cancer patients was more common as compared to weight gain[20]. Weight loss due to cancer was associated with inadequate nutritional intake (estimated energy intake was <60% of requirement for more than one or two weeks)[21] while the activation of catabolic pathways and variety of metabolic and endocrine changes accounted for some of the weight loss[22]. Chemotherapy had negative impact on nutritional status (anorexia, nausea, vomiting, mucositis, and early satiety) and exhibit direct erosive effect on muscle causing significant loss of body mass[22].

Prevalence of Malnutrition

Cancer patients were at high risk for malnutrition due to the disease and treatments which affected their nutritional status[21]. Malnutrition was associated with weight and muscle loss, reduce immune competence, psychological distress, lower quality of life, treatment toxicity and greater mortality risk[21]. A total of 69.5% of the cancer respondents in the inpatient and outpatients settings were found to be malnourished, assessed using PG-SGA. The observation was similar to the prevalence of malnutrition in a cross-sectional study conducted among hospitalized cancer patients in Brazil (77%). The prevalence of disease-related malnutrition ranges from 20% to 80% in cancer patients[23]. Swallowing disorders, dysgeusia, oral mucositis and xerostomia affected nutritional status, oral intake and weight loss in cancer patients[24]. Malnutrition may be due to inadequate food intake, decreased physical activity and catabolic metabolic derangements such as elevated resting metabolic rate, insulin resistance, lipolysis, and proteolysis which worsen weight loss[21]. During cancer treatment, treatment toxicities affected eating patterns which lead to malnutrition resulting in loss of lean body mass and excessive weight loss[25]. Hence, regular nutrition screening should be the initial step before the cancer treatment care plan for assessing patients' nutritional status to prevent complications due to malnutrition.

Asociation between Weight Status, Marital Status and Social Support

Social support was fundamentally significant to the well-being of cancer patients, mitigates cancer-related stress, and associated with improved quality of life[26]. In this study, perceived social support was higher in the domain of family support (97.6%) as compared to the significant others (89.0%) and friends (67.1%). This observation was similar to a study conducted among breast cancer patients in Universiti Kebangsaan Malaysia Medical Centre (UKMMC) which found higher score in family support, assessed using MSPSS tool[27]. Good social support was indeed important for the speedy recovery of cancer patients.

Malnutrition was associated with poor clinical outcome in patients with advanced cancer. In the current study, significant association was found between malnutrition and social support among cancer patients. A total of 55.4% patients with high social support were moderately malnourished while 50% from moderate social support group were well nourished. Moreover, in this study, social support from friends had significant relationship with the weight status of the cancer patients. Surprisingly, 52.6% of cancer patients with moderate support from friends had weight gain. It was undeniable that good social support was related to positive health behaviours among cancer patients, as shown in one of the studies conducted among cancer survivors. Cancer survivors with good social support from friends had active engagement in physical activity and increased consumption of fruits and vegetables due to receiving assistance in purchasing grocery and transportation to shops or parks[28]. Intake of nutritious food and physical activity were able to improve antioxidant defense system by reducing inflammatory response in cancer patients by lowering the levels of cytokines such as C-Reactive Protein (CRP), tumor necrosis factor alpha (TNF-$\propto$), and interleukin-6 (IL-6)[29]. Peer support encouraged patients to express their thoughts and feelings comfortably, enhanced individual self-esteem and obtaining advice from peer is regarded as source of motivation[30-32]. The feeling of hopelessness in cancer patients decreased with increase in their social support[31]. However, the current study also reported contrasting findings of which 63.6% of the patients with high social support from friends reported to have weight loss. This demonstrated that weight among cancer patients was not solely related to social support but was influenced by multiple factors which caused unintended weight loss such as medications, side effects of cancer treatment, and limited food intake due to low appetite[33].

From previous study, pre-treatment cancer-associated weight loss was found to be associated with being unmarried[34]. However, another study showed that marital status did not significantly influence the outcome for lung cancer patients, instead demonstrated that stage of cancer and weight loss were more important prognostic factors predicting the outcome of the disease[35]. This indicated that moral support from other members in the community such as parents, siblings, relatives and friends, were important in determining the well-being of cancer patient instead of focusing on spouse alone.

CONCLUSION

The findings from this study demonstrated the importance of good social support in determining the nutritional status of cancer patients. Social support services in hospitals must be introduced for all cancer patients to enable them to develop effective coping strategies throughout their cancer journey. Besides that, nutritional status of a cancer patient was influenced by various other factors such as inflammation, stage of disease, treatment obtained, and nutritious food intake. Thus, the nutritional status progress of cancer patients must be explored in a longitudinal study and intervention studies can be performed for identifying strategies to manage malnutrition among cancer patients. It was also recommended that future studies must investigate the reasons for poor social support from family, friends and significant others as well as focus on investigating the nutritional status and social support specific for different types and stages of cancers. However, this study had its limitation due to its cross-sectional study design, thus causal relationship could not be established. Moreover, this study only includes patients from one hospital and thus the results could not be generalized to other patients.

Conflict Of Interest

All authors declared no conflict of interest.

Table 5 Association between weight status and social support from family, friends and significant others [presented as n(%)]

	Social support										
	Family (n(%))				Friends (n(%))				Significant others (n(%))			
	Low (n=1)	Moderate (n=1)	High (n=80)	p-value	Low (n=8)	Moderate (n=19)	High (n=55)	p-value	Low (n=1)	Moderate (n=8)	High (n=73)	p-value
Weight status				0.631				0.022*				0.069
Weight loss	0 (0.0)	1 (100.0)	49 (61.3)		8 (100.0)	7 (36.9)	35 (63.6)		0 (0.0)	3 (37.5)	47 (64.4)	
No change	0 (0.0)	0 (0.0)	9 (11.2)		0 (0.0)	2 (10.5)	7 (12.7)		1 (100.0)	1 (12.5)	7 (9.6)	
Weight gain	1 (100.0)	0 (0.0)	22 (27.5)		0 (0.0)	10 (52.6)	13 (23.7)		0 (0.0)	4 (50.0)	19 (26.0)	
Malnutrition status				0.145				0.271				0.066
Stage A (well-nourished)	1 (100.0)	0 (0.0)	24 (30.0)		0 (0.0)	6 (31.6)	19 (34.5)		0 (0.0)	4 (50.0)	21 (28.8)	
Stage B (moderate/ suspected malnourished)	0 (0.0)	0 (0.0)	42 (52.5)		5 (62.5)	10 (52.6)	27 (49.1)		1 (100.0)	1 (12.5)	40 (54.8)	
Stage C (severely malnourished)	0 (0.0)	1 (100.0)	14 (17.5)		3 (37.5)	3 (15.8)	9 (16.4)		0 (0.0)	3 (37.5)	12 (16.4)	

*Significant at p<0.05 tested using Fisher's exact test

REFERENCES

1. Ladas EJ, Gunter M, Huybrechts I, Barr R. A global strategy for building clinical capacity and advancing research in the context of malnutrition and cancer in children within low- and middle-income countries. *J Natl Cancer Inst* 2019;54:149–51. Available from: https://doi.org/10.1093/jncimonographs/lgz023

2. Fares, J., Fares, M.Y., Khachfe, H.H., Salhab, H.A. and Fares, Y., 2020. Molecular principles of metastasis: a hallmark of cancer revisited. *Sig Transduct Target Ther*, *5*(1), pp.1-17. Available from: https://doi.org/10.1038/s41392-020-0134-x

3. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin* 2018;68(6):394–424. Available from: https://doi.org/10.3322/caac.21492

4. Malaysia Ministry of Health. Malaysian Study on Cancer Survival (MySCan). Vol. 4, National Cancer Institute, Ministry of Health Malaysia. 2018. 1–72 p.

5. Muscaritoli M, Lucia S, Farcomeni A, Lorusso V, Saracino V, Barone C, et al. Prevalence of malnutrition in patients at first medical oncology visit: the PreMiO study. *Oncotarget* 2017;8(45):79884-79896.

6. Aoyagi T, Terracina KP, Raza A, Matsubara H, Takabe K. Cancer cachexia, mechanism and treatment. *World J Gastrointest Oncol* 2015; 7(4): 17-29.

7. Zaleta AK, McManus S, LeBlanc TW, Buzaglo JS. Perceptions of unintentional weight loss among cancer survivors. *J Clin Oncol* 2018;36(7):138–138. 10.1200/jco.2018.36.7_suppl.138.

8. Bauer J, Capra S, Ferguson M. Use of the scored Patient-Generated Subjective Global Assessment (PG-SGA) as a nutrition assessment tool in patients with cancer. *Eur J Clin Nutr* 2002;56(8):779–85. Available from: https://doi.org/10.1038/sj.ejcn.1601412

9. Aizer AA, Chen M-H, McCarthy EP, Mendu ML, Koo S, Wilhite TJ, et al. Marital status and survival in patients with cancer. *J Clin Oncol* 2013;31:3869–76. Available from: https://doi.org/10.1200/JCO.2013.49.6489.

10. Yang C-C, Cheng L-C, Lin Y-W, Wang S-C, Ke T-M, Huang C-I, et al. The impact of marital status on survival in patients with surgically treated colon cancer. *Medicine* 2019;98(11):e148562019. Available from: https://doi.org/10.1097/MD.0000000000014856.

11. Niang L, Winn T, Rusli BN. Practical issues in calculating the sample size for prevalence studies. *Orofacial Sciences* 2006;1:9-14.

12. Jamhuri N, Zaidah MYSF, Zaharah AJ, Sharina MHLB, Neoh MK, Aeininhayatey A, et al. Prevalence of malnutrition among hospitalised adult cancer patients at the National Cancer Institute, Putrajaya, Malaysia. *Malays J Nutr* 2017;23(2):161–74.

13. Melo APF, Salles RKD, Vieira FGK, Ferreira MG. Methods for estimating body weight and height in hospitalized adults: a comparative analysis. *Revista Brasileira de Cineantropometria & Desempenho Humano* 2014;16: 475-484.

14. Shahar S, Pooy NS. Predictive equations for estimation of stature in Malaysian elderly people. *Asia Pac J Clin Nutr* 2003;*12*(1).

15. CDC. Body mass index: Considerations for practitioners. Centers for Diseases Control and Prevention: United States of America. 2011;4.

16. Schag CC, Heinrich RL, Ganz PA. Karnofsky performance status revisited: reliability, validity, and guidelines. *J Clin Oncol* 1984;2(3):187–93. Available from: https://pubmed.ncbi.nlm.nih.gov/6699671/

17. Shivanna LM, Kotebagilu NP, Urooj A. Validation of assessment categories of the Patient - generated Subjective Global Assessment Tool in classifying the nutritional status of cancer patients. *Int J Nutr Pharmacol Neurol Dis* 2018;79–85.

18. Ng CG, Amer Siddiq AN, Aida SA, Zainal NZ, Koh OH. Validation of the Malay version of the Multidimensional Scale of Perceived Social Support (MSPSS-M) among a group of medical students in Faculty of Medicine, University Malaya. *Asian J Psychiatr* 2010;3(1):3-6. Available from:https://doi.org/10.1016/j.ajp.2009.12.001.

19. Zimet G. Multidimensional scale of perceived social support (MSPSS)-Scale Items and Scoring Information 2016.

20. Coa KI, Epstein JB, Ettinger D, Jatoi A, McManus K, Platek ME, et al. The impact of cancer treatment on the diets and food preferences of patients receiving outpatient treatment. Nutr *Cancer* 2015;67(2):339-53. Available from: https://doi.org/10.1080/01635581.2015.990577.

21. Arends J, Baracos V, Bertz H, Bozzetti F, Calder PC, Deutz NEP, et al. ESPEN expert group recommendations for action against cancer-related malnutrition. *Clin Nutr* 2017;36(5):1187-96. Available from: https://doi.org/10.1016/j.clnu.2017.06.017

22. Caillet P, Liuu E, Raynaud Simon A, Bonnefoy M, Guerin O, Berrut G, et al. Association between cachexia, chemotherapy and outcomes in older cancer patients: A systematic review. *Clin Nutr* 2017;36(6):1473-82. Available from: https://doi.org/10.1016/j.clnu.2016.12.003.

23. Menon K, Razak SA, Ismail KA, Krishna BVM. Nutrient intake and nutritional status of newly diagnosed patients with cancer from the East Coast of Peninsular Malaysia. *BMC Res Notes* 2014;7(1):1-9. Available from: https://doi.org/10.1186/1756-0500-7-680.

24. Bressan V, Stevanin S, Bianchi M, Aleo G, Bagnasco A, Sasso L. The effects of swallowing disorders, dysgeusia, oral mucositis and xerostomia on nutritional status, oral intake and weight loss in head and neck cancer patients: A systematic review. *Cancer Treat Rev* 2016;45:105-19. Available from: http://dx.doi.org/10.1016/j.ctrv.2016.03.006

25. Greenlee H, Santiago-Torres M, McMillen KK, Ueland K, Haase AM. Helping patients eat better during and beyond cancer treatment. *Cancer J* 2019;25(5):320-8. Available from: https://doi.org/10.1097/ppo.0000000000000405.

26. Korotkin BD, Hoerger M, Voorhees S, Allen CO, Robinson WR, Duberstein PR. Social support in cancer: How do patients want us to help? *J Psychosoc Oncol* 2019;37(6):699-712. Available from: https://doi.org/10.1080/07347332.2019.1580331.

27. Nurasyikin Z, Ihsani MM, . Z, Syed Zulkifli SZ, Nahar Azmi M, Fuad I, et al. Depression, anxiety, stress and perceived social support among breast cancer survivors in tertiary hospital in Malaysia. *KnE Life Sci* 2018;4(4):232. Available from: https://doi.org/10.18502/kls.v4i4.2282.

28. Coleman S, Berg CJ, Thompson NJ. HHS Public Access: social support, nutrition intake, and physical activity in cancer survivors. *Am J Health Behav* 2014;38(3):414-419. Available from: https://doi.org/10.5993/AJHB.38.3.10

29. Boen C, Barrow D, Bnsen J T, Farhan L, Gerstel A, Hendrix L, et al. HHS Public Access: social relationships, inflammation, and cancer survival. Cancer Epidemiol Biomarkers Prev 2018; 27: 541-549. Available from: https://doi.org/10.1158/1055-9965.EPI-17-0836.

30. Usta YY. Importance of social support in cancer patients. *Asian Pacific J Cancer Prev* 2012;13(8):3569-72. Available from: https://doi.org/10.7314/APJCP.2012.13.8.3569

31. Bener A, Alsulaiman R, Doodson L, Agathangelou T. Depression, hopelessness and social support among breast cancer patients: In highly endogamous population. *Asian Pacific J Cancer Prev* 2017;18(7):1889-96. Available from: https://doi.org/10.22034/APJCP.2017.18.7.1889.

32. Rutkowski NA, Lebel S, Richardson K, Mutsaers B, Chasen M, Feldstain A. A little help from my friends: Social support in palliative rehabilitation. *Curr Oncol* 2018;25(6):358-65. Available from: https://doi.org/10.3747/co.25.4050.

33. Ferigollo A, Bazzan LST, Ceni GC, Bohre CT. Prevalence of malnutrition and factors associated with the nutritional status of oncological patients. *Nutr Clín Diet Hosp* 2018; 38(4):137-142. Available from: 10.12873/384ferigollo.

34. Gannavarapu BS, Lau SKM, Carter K, Cannon NA, Gao A, Ahn C, et al. Prevalence and survival impact of pretreatment cancer-associated weight loss: A tool for guiding early palliative care. *J Oncol Pract* 2018;14(4):e238-50. Available from: 10.1200/JOP.2017.025221.

35. Siddiqui F, Bae K, Langer CJ, Coyne JC, Ma VG, Komaki R, et al. The influence of gender , race , and marital status on survival in lung cancer patients. *J Thorac Oncol* 2010;5(5):631–9. Available from: http://dx.doi.org/10.1097/JTO.0b013e3181d5e46a.