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# Prevalence of malnutrition among patients with breast cancer and colorectal cancer in Hospital Tuanku Ja'afar, Seremban

Wei Xiang Wong, Ting Xuan Wong, Shu Hwa Ong, Sangeetha Shyam, Seong Ting Chen, Winnie Siew Swee Chee

## Abstract

**Background:** Malnutrition is common among cancer patients, and it can impact the surgical outcomes of the patients undergoing elective surgery. Addressing malnutrition at the early stage of treatment will enhance the recovery process of the patients after anti-cancer treatments. Our study aimed to assess the nutritional status among breast and colorectal cancer patients who were scheduled for elective surgery and treatment.

**Methods:** A total of 89 patients, 46 breast cancer patients and 43 colorectal cancer patients participated in the study. Sociodemographic information and medical history were collected using a questionnaire. Body weight and height were measured using a weighing scale and stadiometer. Body composition data were collected using an 8-point bioimpedance analysis machine. Dietary intake was collected using a 7-day diet history. Handgrip strength was evaluated using a dynamometer. The prevalence of malnutrition was determined based on the AND/ASPEN malnutrition clinical characteristics. The differences between groups were analysed using independent sample t-test, Mann Whitney U test and chi-square test.

**Results:** Out of 89 patients, 51.7% were diagnosed as being malnourished based on the AND/ASPEN characteristics. The most common malnutrition characteristic observed among the breast and colorectal cancer patients was reduced handgrip strength (56.2%), followed by experience of muscle loss (43.8%) and reduced food intake (42.7%).

**Conclusion:** There was a high prevalence of patients at risk of malnutrition among breast and colon cancer patients undergoing surgery. Early detection of malnutrition in cancer patients allows healthcare professionals to provide prompt intervention and improve their prognosis.

***Keywords:*** *Malnutrition; nutrition assessment; hospital; breast cancer; colorectal cancer*

## Introduction

Cancer is one of the leading causes of death worldwide, which accounts for up to nearly 10 million deaths in 2020.[1] Breast cancer and colorectal cancer are the most common type of cancers not only worldwide but also in Malaysia. There is a high prevalence of breast cancer and colorectal cancers in Malaysia, accounting for 17.3% and 14.0% of the total number of cancer incidences respectively.[2] Malnutrition is common among cancer patients, be it among newly-diagnosed cancer patients or patients with advanced-stage cancer. A study on the nutritional status assessment among cancer patients in National Cancer Institute, Malaysia conducted by Norshariza et al. found that the prevalence of malnutrition ranged from 43.5% to 61.9%.[3] Another study conducted by Menon *et al.* on the east coast of Peninsular Malaysia found that more than one-third of the cancer patients were malnourished at the point of diagnosis.[4]

Malnutrition can be defined as deficiency, excess or imbalance in either macronutrients or micronutrients intake of an individual.[5] Malnutrition among cancer patients is either caused by the disease itself or from the cancer treatment.[6–8] Cancer itself affects the dietary intake of patients, increasing the energy expenditure and putting patients in a negative energy balance. Changes in nutrient metabolism and inflammation will also

*Division of Nutrition and Dietetics, School of Health Sciences, International Medical University, Kuala Lumpur, Malaysia*

*Address for Correspondence:*

Wei Xiang Wong, Division of Nutrition and Dietetics, School of Health Sciences, International Medical University

*No. 126, Jalan Jalil Perkasa 19, Bukit Jalil, 57000 Kuala Lumpur*, Malaysia

Email: womgweixiang85@gmail.com

affect the overall nutritional status.[8–11] Chemotherapy is reported to affect nutritional status by inducing metabolic abnormalities such as hyperglycaemia, hypercalcaemia, or micronutrients deficiencies, thus affecting the immune competency of the patients. Radiotherapy has a direct impact on the taste buds of the tongue, thus affecting the taste changes among cancer patients.[8] In addition, surgical procedures to treat cancer can increase the nutritional requirement of the patients in the recovery process.[12] When the surgical procedure involves the gastrointestinal track, there is a chance of reduced food intake after the surgical procedure.[13] A study conducted by Williams *et al.* on the effect of cancer resection reported that muscle loss may last up to 6 weeks after a surgical procedure.[7]

Malnutrition is associated with an increased length of hospital stay.[14] Marshall *et al.* found that cancer inpatients categorised as malnourished have a mean length of hospital stay of 20 days, and it is significantly longer than well-nourished cancer patients.[14] Another similar study conducted by Loan *et al.*, reported that the mean length of hospital stay of well-nourished patients is 3 days shorter than malnourished patients after surgical procedures.[15] The rate of hospital readmission is also associated with the nutritional status of the patients. Several studies have associated malnutrition status as an independent risk factor for increased readmission rate.[16,17]

Currently, there is no single, universally accepted approach to the identification of adult malnutrition. In 2009, the Academy of Nutrition and Dietetics (AND) and American Society for Parenteral and Enteral Nutrition (ASPEN) recognised the need to standardise the definition to the diagnosis of malnutrition in adults and to manage the efforts among their respective organizations.[18] The International Consensus Guideline Committee was formed to develop an aetiology-based approach to the diagnosis of adult malnutrition in clinical settings. Thus, AND/ASPEN malnutrition clinical characteristics was developed on a consensus basis. This tool investigates the six (6) characteristics, recommended by the group in the diagnosis of adult malnutrition. The characteristics include insufficient energy intake, weight loss, loss of muscle mass, loss of subcutaneous fat, fluid accumulation and diminished functional status.[19] This study aimed to evaluate the prevalence and characteristics of malnutrition among patients diagnosed with breast and colorectal cancer from a large tertiary hospital in Seremban, Malaysia using the AND/ASPEN diagnostic criteria, to compare their similarities and differences.

## Materials and Methods

### *Study design and participants*

This was a cross-sectional study conducted at the surgical outpatient department of Hospital Tuanku Ja'afar, Seremban, Malaysia (HTJ, SOPD). The study period was from December 2018 to January 2020. Ethics approval was obtained from the Malaysian Medical Research and Ethics Committee (NMRR-18-392-40035 (IIR)) and the International Medical University Joint Committee on Research and Ethics (IMU R 204/2017). Written informed consent was obtained from the patients before enrolment into the study.

A total of 89 breast and colorectal cancer patients who were preparing for elective surgery were recruited. The recruited patients were: (1) registered adult outpatients at SOPD, HTJ, (2) aged 18 years old and above and (3) scheduled for elective surgery. Patients who were diagnosed with dementia, pregnant or

lactating mothers, on enteral or parenteral feeding and had physical impairments were excluded from the study.

***Sample size calculation***

The sample size was calculated using a single population proportion formula: $n=\frac{Z^2\times[p(1-p)]}{d^2}$ with n = the required sample size, Z = 1.96, p = prevalence of malnutrition reported among hospitalised cancer patient, and d = precision (assumed at 0.10). Based on the literature search, a study among hospitalised head and neck patients reported a prevalence of malnutrition at 67% using AND/ASPEN malnutrition characteristic tool.[20] Therefore, the minimum sample size required for the present study was estimated at 85 patients.

**Measurement**

***Questionnaire***

Sociodemographic data including age, date of birth, gender, ethnicity, marital status, educational level, employment status, monthly household income and medical history were collected via interview using a standardised questionnaire. The median household expenditure survey reported by the Department of Statistics in 2019 was used in categorising the household income of the patients.[21] Monthly household income of less than RM 4,850 was categorised as B40, monthly income range from RM 4,850 to RM 10,959 categorised as M40 and monthly income of more than RM 10,959 was categorised in the T20 group.

***Anthropometry***

The body weight of the patients was measured to the nearest 0.1kg using a calibrated digital weighing scale (Tanita bathroom weighing scale Model HD-325, Tanita Corporation, Tokyo, Japan). The patients were weighed in light clothing, requested to remove any heavy objects which could contribute to the weight and step on the weighing scale with no support, stand evenly on both feet and look straight ahead. Patients' height was measured to the nearest 0.1cm using a stadiometer (Seca 213, Seca, Hamburg, Germany). The patients were requested to stand evenly on both feet. The buttocks, scapulae, and head were positioned in contact with the vertical backboard, and their head in a Frankfort plane position.

Body mass index (BMI) was calculated using the formula of weight (in kilogram) divided by the square of height (in meter). The cut-off point for the BMI is based on the Asia Pacific classification system: BMI <18.5kg/$m^2$ is categorised as underweight, BMI of 18.5 kg/$m^2$ – 22.9kg/$m^2$ as normal, BMI between 23kg/$m^2$ – 24.9kg/$m^2$ as overweight and BMI >25kg/$m^2$ as obese.[22] The body weight changes were obtained from the medical record of the patients or from patients self-report.

***Body composition***

The body composition data were measured using a body impedance analysis machine (SECA 8-point body impedance analysis machine mBCA 525, Seca, Hamburg, Germany). Patients were required to empty their bladder before the measurement of body composition. Patients need to lie in a supine position on a non-conductive surface, spread their arms and legs away from the body and lie still. The eight adhesive electrodes were placed at the extremities of the limbs. Fat mass, fat-free mass, and appendicular muscle mass were measured.

***Handgrip strength***

The handgrip strength (HGS) of the patients was assessed using a calibrated Jamar Hydraulic Hand

Dynamometer, which is expressed in KgForce (KgF). The patients held the dynamometer in the hand to be tested, with the arm at right angles and the elbow by the side of the body. The patients were encouraged to squeeze the handgrip as hard as they could, the reading was measured based on the value shown by the peak hold needle. Measurements were repeated three times and the highest measurement was used to compare to the normative grip strength.[23]

***Dietary intake***

The dietary intake of the patients was collected using a 7-days diet history. Food album and household measurement tools were used to aid in the dietary intake assessment. The diet history was analysed using computer software (NutritionistPro, Axxya System LLC, Redmond USA). Energy, macronutrients and micronutrients of the diet were analysed based on the nutrient composition from the Nutrient Composition of Malaysian Food[24] and Singapore Energy and Nutrients Composition of Food.[25] For packaged and processed food, the food manufacturer's nutrition information label was used to calculate the nutrient content.

***Definition of sarcopenia***

Sarcopenia was defined based on the Asian Working Group for Sarcopenia's recommendation.[26] Patients who were categorised as both low HGS and low muscle mass were diagnosed with sarcopenia. Low HGS was defined as <28.0kgF for men and <18.0kgF for women. Low muscle mass was defined as appendicular muscle mass index (AMMI) of <7.0kg/$m^2$ for men and <5.7kg/m2 for women.[26]

***Diagnosis of malnutrition***

The AND/ASPEN malnutrition clinical characteristics were evaluated as follows: reduced energy intake, unintentional weight loss, muscle mass loss, fat mass loss, signs of oedema and reduced HGS. The presence at a minimum of two out of the six characteristics was considered as moderate or severe malnutrition, according to the proposed classification in the original AND/ASPEN statement.[18]

**Statistical analysis**

The descriptive data were presented as mean ± standard deviation (SD) or median, interquartile range (IQR) depending on the normality of the data. The prevalence of malnutrition in the sample is expressed as a percentage (95% CI). The data were analysed using IBM SPSS statistics version 20.

**Results**

Out of 256 potential patients approached in the hospital, 89 patients who consented to join the study were screened for their participation eligibility and were recruited.

Table I shows the sociodemographic and clinical characteristics of the patients. The majority of the patients were Malays (57.3%), followed by Chinese (24.7%) and Indians (18.0%). The mean age of the patients was 60±11 years old and 77 of them were married (86.5%). Almost 90% of the patients were from the lower-income group with a monthly household income of less than RM 4,850.

There was an almost equal proportion of patients with breast cancer (51.7%) and colorectal cancer (48.3%). Other co-morbidities including hypertension (51.7%), diabetes mellitus (34.8%) and cardiovascular disease (25.8%) were reported among the patients.

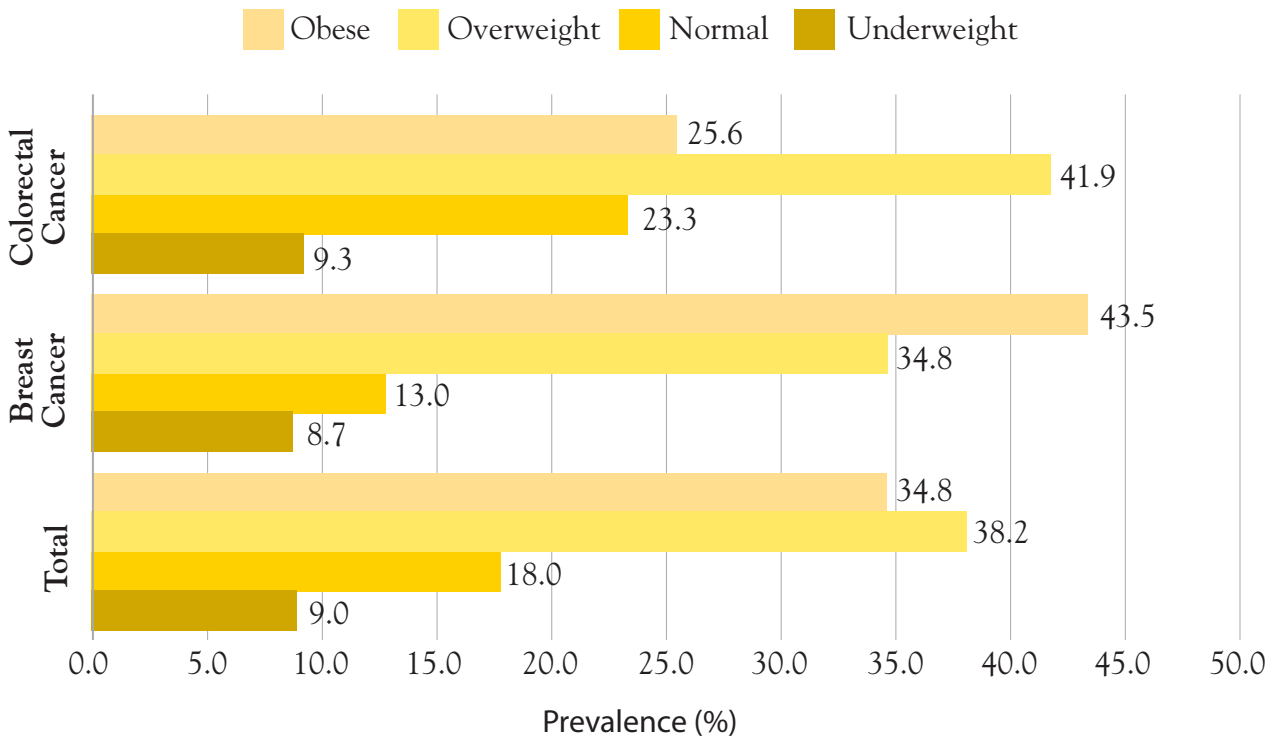
**Table I: Sociodemographic and clinical data of the patients, based on the type of cancer**

| Characteristics | Total (N=89) | Breast Cancer (n=46) | Colorectal Cancer (n=43) |
|---|---|---|---|
| **Age, years (mean ± SD)** | 60 ± 11 | 56 ± 12 | 62 ± 9 |
| **Sex** | | | |
| Male | 26(29.2) | 0(0.0) | 26(60.5) |
| Female | 63(70.8) | 46(100.0) | 17(39.5) |
| **Ethnicity** | | | |
| Malay | 51(57.3) | 27(58.7) | 24(55.8) |
| Chinese | 22(24.7) | 9(19.6) | 13(30.2) |
| Indian | 16(18.0) | 10(21.7) | 6(14.0) |
| **Marital Status** | | | |
| Single | 4(4.5) | 3(6.5) | 1(2.3) |
| Married | 77(86.5) | 38(82.6) | 39(90.7 |
| Widow/Widower | 5(5.6) | 3(6.5) | 2(4.7) |
| Divorced/Separated | 3(3.4) | 2(4.3) | 1(2.3) |
| **Education Level** | | | |
| No formal education | 4(4.5) | 2(4.3) | 2(4.7) |
| Primary | 31(34.8) | 14(30.4) | 17(39.5) |
| Secondary | 43(48.3) | 21(45.7) | 22(51.2) |
| College/University | 11(12.4) | 9(19.6) | 2(4.7) |
| **Employment Status** | | | |
| Employed | 28(31.5) | 13(28.3) | 15(34.9) |
| Unemployed | 61(68.5) | 33(71.7) | 28(65.1) |
| **Monthly Household Income*** | | | |
| B40 (< RM 4,850) | 80(89.9) | 40(87.0) | 40(93.0) |
| M40 (RM 4,850 – RM 10,959) | 7(7.9) | 5(10.9) | 2(4.7) |
| T20 (> RM 10,959) | 2(2.2) | 1(2.2) | 1(2.3) |
| **Other Comorbidities** | | | |
| Diabetes Mellitus | 31(34.8) | 19(41.3) | 12(27.9) |
| Hypertension | 47(52.8) | 27(58.7) | 20(46.5) |
| Cardiovascular Disease | 23(25.8) | 13(28.3) | 10(23.3) |
| **History of Chemotherapy** | | | |
| Yes | 6(6.7) | 2(4.3) | 4(9.3) |
| No | 83(93.3) | 44(95.7) | 39(90.7) |
| **History of Radiotherapy** | | | |
| Yes | 11(12.4) | 2(4.3) | 9(20.9) |
| No | 78(87.6) | 44(95.7) | 34(79.1) |

**Monthly household income categories were based on household expenditure survey report 2019*

The mean weight of the patients was 63.8±13.2kg and the mean height was 1.56±0.10m. The mean height of colorectal cancer patients was significantly higher than breast cancer patients (1.60±0.10m vs 1.53±0.06m, p<0.001), mainly due to the differences in sex characteristics of the patients. There was a low prevalence of weight loss among cancer patients, of which 79.8% of the patients did not experience any weight loss. Breast cancer patients had a significantly higher BMI than colorectal cancer patients (27.7±6.9kg/$m^2$ vs 24.8±4.7kg/$m^2$, p=0.024). Figure I shows the prevalence of BMI categories of the patients, based on the type of cancer. There is a high prevalence of patients categorised as overweight (38.2%) and obese (34.8%). Among breast cancer patients, 16 of them were categorised as overweight (34.8%) and 20 were categorised as obese (43.5%). For colorectal cancer patients, 18 of them were categorised as overweight (41.9%) and 11 were categorised as obese (25.6%).

**Figure I: Body Mass Index (BMI) of the patients, based on the type of cancer**




*BMI categories was based on WHO classification of BMI for Asian population. Underweight = <18.5kg/m2, Normal = 18.5kg/m2 – 24.9kg/m2, Overweight = 25.0kg/m2 – 29.9kg/m2, Obesity = ≥30kg/$m^2$.* [22]

The body composition data, HGS and prevalence of sarcopenia are shown in Table II. Overall, breast cancer patients were found to have a higher fat mass (28.65±10.27kg vs 20.51±8.13kg, p<0.001) and lower fat-free mass (36.93±7.06kg vs 42.87±10.00kg, p=0.002) in comparison with colorectal cancer patients. Eleven patients were categorised as being sarcopenic (12.4%) with 5 among breast cancer patients (10.9%) and 6 among colorectal cancer patients (14%).

**Table II: Body composition data, handgrip strength and prevalence of sarcopenia of the patients, based on the type of cancer**

| Characteristics | Overall (N=89) | Breast Cancer (n=46) | Colorectal Cancer (n=43) |
|---|---|---|---|
| | | Mean ± SD | |
| Fat Mass, kg | 24.72±10.11 | 28.65±10.27 | 20.51±8.13 |
| Fat Mass Index, kg/m$^2$ | 10.46±5.10 | 12.49±5.25 | 8.29±3.97 |
| Fat Free Mass, kg | 39.80±9.07 | 36.93±7.06 | 42.87±10.00 |
| Fat Free Mass Index, kg/m$^2$ | 15.92±2.38 | 15.36±2.12 | 16.50±2.53 |
| Appendicular Muscle Mass, kg | 9.66±2.89 | 8.73±2.12 | 10.66±3.27 |
| Appendicular Muscle Mass Index, kg/m$^2$ | 6.14±1.58 | 5.70±1.30 | 6.60±1.73 |
| Handgrip Strength, kgF | 28±8 | 25±7 | 30±10 |
| | | **n(%)** | |
| **Sarcopenic*** | **11(12.4)** | **5(10.9)** | **6(14.0)** |

*Data presented as mean±SD*

**Sarcopenia is based on consensus by the Asian Working Group for Sarcopenia (AWGS), which meets both low HGS and low AMMI. Low HGS is defined as <28.0kgF for men and <18.0kgF for women, low AMMI is defined as <7.0kg/m$^2$ for men and <5.7kg/m$^2$ for women.*

The dietary intake of the patients is presented in Table III. The overall mean energy intake was 1259±472kcal with a macronutrient distribution of 52% from carbohydrates, 16% from protein and 32% from fat. The majority of patients had inadequate intake of micronutrients and a high percentage of patients did not meet the recommended intakes for calcium, thiamine and niacin in both groups of patients.

**Table III: Dietary intake of the patients, based on the type of cancer**

| Nutrients | Overall (N=89) | Breast Cancer (n=46) | Colorectal Cancer (n=43) |
|---|---|---|---|
| | | Mean ± SD | |
| **Energy Intake** | | | |
| Energy Intake, kcal | 1259±472 | 1191±365 | 1332±559 |
| **Protein Intake** | | | |
| Protein intake, g | 50±23 | 47±17 | 54±29 |
| Percentage energy intake, % | 16±4 | 15±4 | 25±16 |
| **Carbohydrate intake** | | | |
| Carbohydrate intake, g | 165±63 | 161±45 | 170±77 |
| Percentage energy intake, % | 52±8 | 52±6 | 52±10 |
| **Fat Intake** | | | |
| Fat intake, g | 46±20 | 45±14 | 46±25 |
| Percentage energy intake, % | 32±7 | 33±5 | 31±9 |
| **Calcium Intake** | | | |
| Calcium mg | 444±371 | 379±218 | 514±478 |
| Intake < RNI, n(%) | 85(95.5) | 46(100) | 39(90.7) |
| **Iron Intake** | | | |
| Iron, mg | 11±5 | 11±4 | 11±5 |
| Intake < RNI, n(%) | 56(62.9) | 30(65.2) | 26(60.5) |
| **Thiamin Intake** | | | |
| Thiamin, mg | 1.0±2.7 | 0.6±0.3 | 1.3±3.8 |
| Intake < RNI, n(%) | 78(87.6) | 43(93.5) | 35(81.4) |
| **Riboflavin Intake** | | | |
| Riboflavin, mg | 1.2±2.7 | 0.9±0.4 | 1.5±3.8 |
| Intake < RNI n(%) | 64(71.9) | 35(76.1) | 29(67.4) |
| **Niacin Intake** | | | |
| Niacin, mg | 7.6±12.5 | 5.9±2.9 | 9.5±17.7 |
| Intake < RNI, (%) | 85(95.5) | 45(97.8) | 40(93.0) |
| **Vitamin C Intake** | | | |
| Vitamin C, mg | 93±79 | 97±85 | 90±73 |
| Intake < RNI, n(%) | 45(40.6) | 23(50.0) | 22(51.2) |
| **Vitamin A Intake** | | | |
| Vitamin A, µg | 742±555 | 768±606 | 714±500 |
| Intake < RNI, n(%) | 41(46.1) | 20(43.5) | 21(48.8) |

*Data presented as mean±SD and n(%)*

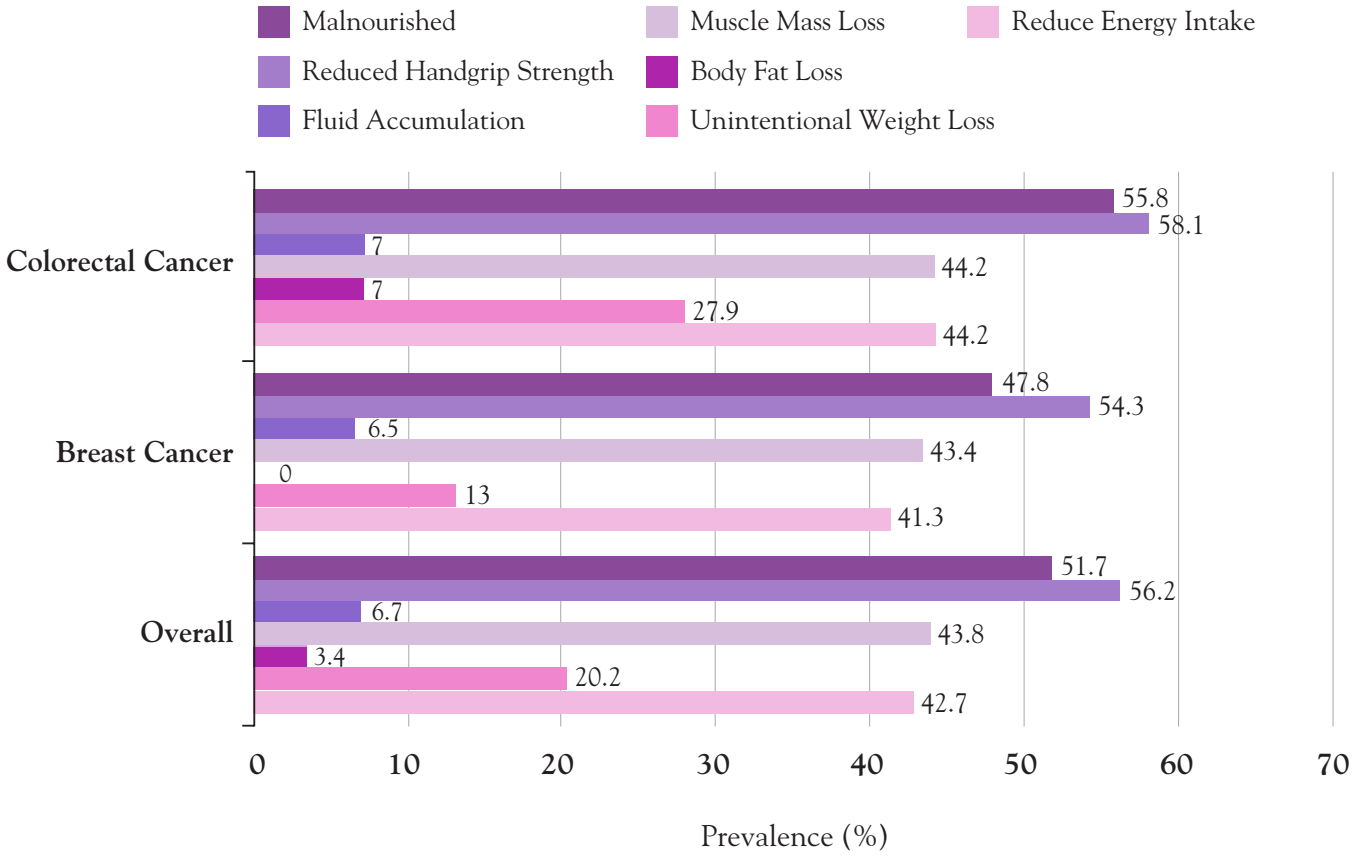
*RNI: Recommended Nutrients Intake according to National Coordinating Committee on Food and Nutrition 2017.*

The overall nutrition status of the patients based on AND/ASPEN malnutrition clinical characteristics is shown in Table IV. About 51.7% of the patients were classified as malnourished with an almost equal proportion among breast and colon cancers. The key malnutrition characteristics observed within the patients were reduced energy intake (42.7%), muscle loss (43.8%) and low HGS (56.2%). There was however no significant difference in the malnutrition characteristics between breast and colon cancer patients.

**Table IV: Prevalence of malnutrition of the patients, based on the type of cancer**

| AND/ASPEN Malnutrition Clinical Characteristic | Overall (N=89) | Breast Cancer (n=46) | Colorectal Cancer (n=43) |
|---|---|---|---|
| | | % (95% CI) | |
| **Reduced Energy Intake** | 42.7 (32.3 – 53.6) | 41.3 (27.0 – 56.8) | 44.2 (29.1 – 60.1) |
| **Unintentional Weight Loss** | 20.2 (12.4 – 30.1) | 13.0 (4.9 – 26.3) | 27.9 (15.3 – 43.7) |
| **Body Fat Loss** | 3.4 (0.7 – 9.5) | 0.0 (0.0 – 7.7) | 7.0 (1.5 – 19.1) |
| **Muscle Mass Loss** | 43.8 (33.3 – 54.7) | 43.4 (28.9 – 58.9) | 44.2 (29.1 – 60.1) |
| **Fluid Accumulation** | 6.7 (2.5 – 14.1) | 6.5 (1.4 – 17.9) | 7.0 (1.0 – 19.1) |
| **Reduced Handgrip Strength** | 56.2 (48.6 – 69.8) | 54.3 (39.0 – 69.1) | 58.1 (42.1 – 73.0) |
| **Overall Nutrition Status** | 48.3 | 52.2 | 44.2 |
| Well Nourished | (37.6 – 59.2) | (36.9 – 67.1) | (29.1 – 60.1) |
| Malnourished | 51.7 (40.8 – 62.4) | 47.8 (32.9 – 63.1) | 55.8 (39.9 – 70.9) |

**Figure II: Prevalence of malnutrition of the patients, based on the type of cancer**




## Discussion

Our study found that almost one out of two breast and colorectal cancer patients undergoing elective surgery were malnourished based on AND/ASPEN malnutrition clinical characteristics tool even though the majority were overweight or obese. In addition, the malnourished patients had a poor dietary intake, muscle loss and poor handgrip strength (HGS).

The BMI of most patients was classified as being overweight or obese. This is not surprising as BMI is a risk factor for colorectal and breast cancers. With every 5kg/m$^2$ increase in the BMI, the risk of colorectal cancer would increase by 1.13 times and the risk of breast cancer would increase by 1.07 times.[27] A high body fat mass could also be one of the potential contributors to increased risk of breast cancer, which was reported by Schoemaker *et al.*[28]

It was also interesting to note that most patients did not experience unintentional weight loss at the point of diagnosis of cancer. Kroenke *et al.* conducted an analysis of BMI among colorectal cancer patients and they found no significant difference in BMI between pre-diagnosis and at the point of diagnosis.[29] A similar study conducted by Patel *et al.* among breast cancer patient and healthy subject in the United State of America found no significant difference in BMI between patients diagnosed with breast cancer and participants with no breast cancer was noticed.[30]

Our study also found that a majority of patients had low energy intakes of less than 25kcal/kg body weight and protein intakes of less than 0.8g/kg body weight. The low energy and protein intakes among cancer patients have been similarly reported by Menon *et al.* among newly diagnosed cancer patients on the east coast of Peninsular Malaysia. Low energy and protein intakes could be a result of under-reporting.[31] However, these patients could also be making changes to their dietary intake patterns intentionally. Yusof *et al.* found that there were changes in dietary patterns among colorectal cancer patients.[32] Conscious or intentional dietary intake pattern changes, such as reduced frequency of eating out, reduced oily food intake, reduced red meat, reduced high sugar food items and increased fruit and vegetable intake, were seen when the patients were diagnosed with cancer.[33]

Our study found that almost 50% of the patients were malnourished according to the AND/ASPEN malnutritional clinical characteristics. Other studies conducted in clinical settings showed the prevalence of malnutrition ranged from 26.8% to 72.6%, and was dependent on the type of disease or the condition of the study populations.[34–42] Hudson *et al.*, 2018 conducted a study on the prevalence of malnutrition in an overall clinical setting in the Hospital of the University of Pennsylvania using AND/ASPEN malnutritional clinical characteristics and reported that 66.88% of the patients were malnourished.[34] Another study conducted by Burgel *et al.* on the inpatients from 5 hospitals in Brazil, where the patients were mainly diagnosed with cancer, heart disease and lung and gastrointestinal disorder, reported that 34.6% of the patients met the malnutrition criteria of AND/ASPEN malnutrition clinical characteristics.[36] The high prevalence of malnutrition indicates the importance of nutrition screening and assessment to be done during diagnosis and preparation for anticancer treatments.

In our current study, the main contributing factors to malnutrition were poor dietary intake, low muscle mass and low HGS. The contributing factors for poor dietary intake could be due to under-reporting of the patients and changes in dietary pattern after cancer diagnosis. Low energy intake might further induce the depletion of body reservoirs, resulting in the unintentional weight loss of the patients. The weight loss would then impair the physical performance of an individual, and increase the odds ratio of overall morbidity and mortality rate after elective surgery.[43]

Muscle loss among patients diagnosed with cancer was also found to impact the prognosis of the disease. Among patients diagnosed with colorectal cancer, it was found that muscle loss after systemic chemotherapy is significantly associated with shorter progression-free survival and overall survival.[44–46] Other than that, muscle loss was also found to be associated with overall survival among metastatic colorectal cancer patients, independent of tumour mutational status and weight loss.[47]

Reduced HGS among cancer patients should not be neglected as well. It was found that reduced HGS is associated with impaired health-related quality of life. It was found that patients categorised as having reduced HGS were having poorer mobility, inability to conduct usual activity and higher risk of pain and discomfort.[48,49] In addition, patients diagnosed with cancer and having low HGS were found to have an associated increased odds ratio of postoperative complications, including infection and increased mortality rate.[50–52]

The present study had several limitations. The single centre recruitment and the small sample size of the current study limited its generalisation. The result should therefore be interpreted with caution. Recognising the barriers to recruit patients who were diagnosed with cancer as participation in a study might be perceived as an additional burden for the patients.[53,54] A multi-centre study should be considered in the future study to allow for a larger sample size recruitment and better comparison between types of cancer.

## Conclusion

This study investigated the prevalence of malnutrition among breast and colorectal cancer patients by using AND/ASPEN malnutrition characteristics. Half of the patients were diagnosed as malnourished based on AND/ASPEN and it was mainly contributed by the symptoms of muscle loss, reduced food intake and reduced handgrip strength. Early detection of these symptoms and optimising nutrition status through nutritional intervention before conducting any cancer treatment might improve the prognosis of the disease.

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