

## Nutritional Status in Breast and Cervical Cancer Survivors: Differences in Each Stage of Survivorship

Ni Putu Wulan Purnama Sari

*Department of Palliative Nursing, Widya Mandala Catholic University Surabaya.*

### Abstract

**Objective:** Nutrition is one important physical aspect supporting the achievement of optimum quality of life (QOL) in cancer survivors. This study aimed to 1) compare and analyze the differences in nutritional status between breast and cervical cancer survivors (BCS and CCS) generally, and between stages of survivorship specifically in both cases, and 2) determine the best predictor of nutritional status in both cases. **Method:** This cross-sectional study involved 58 BCS and 47 CCS (n=105). The questionnaire of PG-SGA was used in data collection. Various statistical tests were used in data analysis ( $\alpha < 0.05$ ). **Result:** Nutritional status was not significantly different between BCS and CCS ( $p = 0.116$ ), but significant differences found in activities and function between cases ( $p = 0.040$ ). In BCS, nutritional status was not significantly different between survivorship stages ( $p = 0.068$ ), which indicates that this aspect is stable/stagnant across the survival life span in this case. While in CCS, nutritional status was also not significantly different between survivorship stages ( $p = 0.382$ ), but the intake and physical exam were significantly different in this case ( $p = 0.040$  and  $p = 0.008$ , respectively) which indicate that these two aspects change over time along with the survivorship stages in CCS. Body Mass Index (BMI) is the best predictor of nutritional status in BCS, which were accounted for 15.9% variance of nutritional status ( $R^2 = 0.159$ ); while weight loss is the best predictor of nutritional status in CCS, which were accounted for 49.6% variance of nutritional status ( $R^2 = 0.496$ ). **Discussion:** More significant predictors of nutritional status were found in CCS compared to BCS.

**Keywords:** *Breast cancer, Cancer survivors, Cervical cancer, Nutrition, Nutritional status.*

### Introduction

Certain genes involved in the control process of cell regeneration contributed to the development of cancer because they were damaged and grew abnormally. The initiation of cancer begins when cells grow out of control and crowd out normal cells. Cancer is not just one disease, and it can start in various parts of our body. In women, mostly cancer starts in the breast or cervix. Globally, breast cancer incidence annual increased rate was 3.1%, while 0.6% for cervical cancer [1].

Since 2014, the incidence of breast cancer ranked highest and followed by cervical cancer in the second rank in Indonesian cancer statistics [2]. Nothing changed much until now. The estimation of cancer incidence in Indonesia is 0.1%, and the worst is that most individuals are firstly seeking professional help in an advanced stage [3]. Nowadays, we can see more cancer patients live longer than the previous times, thanks to the advancement of diagnosis and therapy.

These patients are often called cancer survivors. There are three stages of cancer survivorship, namely: acute (<1 year), short term (1-5 years), and long term survivorship (>5 years) [4]. In the Surabaya community nowadays, most female cancer patients were acute or short term survivors, in which longer life expectancy was found in those with advanced-stage cervical cancer making them a long term cancer survivor [5].

Cancer patients are prone to experience changes in nutritional status. Cancer is associated with weight loss and nutritional problems [6]. Nutrition can affect tumor biology, co-morbidity, and therapeutic response, especially in cancer patients [7]. Cancer is the body, and the carried out therapy makes nutritional problems worse. In general, cancer therapy includes surgery, chemotherapy, and radiation. Chemotherapy is a kind of therapy utilizing chemical substances for killing cancer cells systemically [8].

The National Cancer Institute states that the use of Anthracycline drugs as chemotherapy (for example, Adriamycin, Doxorubicin) can cause side effects of nausea, vomiting, diarrhea, stomatitis, and often complain of changes in food taste. Chemotherapy has various direct side effects, severe nausea, and vomiting, for instance. These two symptoms appear because there are certain antitumor substances in the chemotherapy drug affecting the hypothalamus and brain chemoreceptors at the center of nausea-vomiting.

Lack of calories and protein intake increases the infection risk and slows the recovery process after chemotherapy [9,10]. Post-chemotherapy cancer patients can experience malnutrition even before being treated, and also experience metabolic disorders [9]. Malnutrition is a condition of impaired nutrition where there is an excess of nutrient deficiency at various levels by the sign of inflammatory activities that result in composition changes and decreased body function [6]. The estimated incidence of malnutrition among cancer patients is approximately 40-80% [10].

Cancer patients had malnutrition because of the disease mechanism, host response towards the tumor, and side effects of anti-cancer therapy [11]. In malnourished patients, lack of energy, protein, and other nutrients can hurt the formation of body tissues, composition, functions, and clinical outcomes. Malnutrition is associated with not only decreased QOL, therapeutic response, and survival, but also a high risk of chemotherapy-induced toxicity in cancer patients [12].

The physical response of cervical cancer patients (CCP) under chemotherapy are nausea, vomiting, constipation, weight loss, decreased appetite, and taste changes in which all symptoms contributed to decreased intake [13]. While after chemotherapy, malnutrition in CCP may also happen due to diarrhea associated with diet, cancer stadium, and stress [14]. The nurse can provide spiritual, emotional freedom technique in CCP under chemotherapy to manage stress so that there will be no effect on intake [15,16] while the physical response of breast cancer patients (BCP) under adjuvant chemotherapy are nausea, vomiting, and lack of appetite [17]. Even with those symptoms, specifically in acute

survivor BCP, the opposite situation happened in which overweight and obesity were highly prevalent with suboptimal dietary intake consumed [18]. The nurse can provide progressive muscle relaxation therapy to improve nausea, vomiting, and lack of appetite in BCP under adjuvant chemotherapy [19]. Generally, conflict, anxiety, and depression, which occurred specifically in cancer patients with acute survivorship stage and after-therapy period, may result in decreased intake [20].

The nurse can provide biblio care in various cancer patients under chemotherapy to manage depression so that there will be no effect on intake [21]. Nutrition is one important physical aspect supporting the achievement of optimum QOL in cancer survivors. A study towards 97 cancer patients showed that most respondents were well-nourished, and global QOL was significantly different across the Subjective Global Assessment groups [22]. Seven aspects built the construct of nutritional status according to Ottery [11], namely: weight, food intake, symptoms, activities & function, disease and its relation to nutritional requirements, metabolic demand, and physical exam.

In this study, Ottery's global construct of nutritional status was implemented in the case of breast and cervical cancer. This study aimed to: 1) compare and analyze the differences in nutritional status between breast and cervical cancer survivors (BCS and CCS) generally, and between stages of survivorship specifically in both cases, and 2) determine the best predictor of nutritional status in both cases.

## Method

A cross-sectional design was utilized in this study. There were 58 BCS, and 47 CCS participated as study respondents, which consisted of 27, 45, and 33 acute, short-term, and long-term survivors, respectively. Only adult patients who were eligible to be study respondents. The respectable PHC should confirm the cancer diagnosis, and there was a palliative volunteer who was in charge of a regular home visit. Individuals with poor conditions, those who were denied the informed consent, and losing consciousness or disoriented were excluded from this study. The researcher got the patients' data from the head of the palliative volunteer; then the

data collection process was done in a “door to door” basis by accompanying the palliative volunteer in charge because the patients were unfamiliar with the researcher. Nutritional status was the sole variable in this study, which consisted of various aspects to be measured according to Ottery [11]. It was measured by the instrument of Patient-Generated Subjective Global Assessment (PG-SGA), which developed by Ottery [11].

This instrument has been revised several times since 2001, 2005, 2006, until the latest version was published in 2014. PG-SGA consists of two parts; the first part is specifically designed to be filled by the patient himself (self-reported), while the second part is filled by health care professional. The first part consists of four aspects of assessment, namely: weight, food intake, symptoms, and activities & function.

The second part consists of three aspects of assessment, namely: disease and its relation to nutritional requirements, metabolic demand, and physical exam. At present, the PG-SGA instrument has been used internationally as a screening method for proactively assessing the risk of malnutrition, assessing nutritional status, monitoring, and evaluating the effectiveness of nutritional interventions in cancer patients. This instrument has the advantage that the patient's nutritional status is seen as dynamic, so many experts choose to use PG-SGA as a research instrument [11].

PG-SGA was translated into the Indonesian language by the researcher to be suitably implemented into Indonesian. The results of the instrument testing procedure towards 105 respondents of female cancer showed that PG-SGA was valid ( $r = 0.377 - 0.864$ ) and highly reliable (Chronbach Alpha = 0.713). PG-SGA categorized nutritional status into three, namely: well-nourished (stage A), moderately malnourished (stage B), and severely malnourished (stage C), based on the assessment of weight, nutrient intake, nutrition impact symptoms, functioning, and physical exam. Stage A is characterized by no weight loss or recent weight gain, no deficit or significant recent

improvement of nutrient intake, no symptom or significant recent improvement allowing adequate intake, no deficit or recently improved functioning, no deficit or chronic deficient but tissue, or recent improvement. Stage B is characterized by less than 5% weight loss in one month or 10% in six months or progressive weight loss, definite decrease in nutrient intake, present of nutrition impact symptoms, moderate functional deficit or recent deterioration, and evidence of mild to moderate loss of muscle mass / SQ fat/muscle tone on palpation.

Stage C is characterized by more than 5% weight loss in one month or 10% in six months or progressive weight loss, severe deficit in intake, present of nutrition impact symptoms, severe functional deficit or recent significant deterioration, obvious signs of malnutrition (e.g., severe loss muscle, SQ possible edema) [11].

Ethical clearance was issued by the Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia, with a certificate number of 681-KEPK. Data were collected from February until March 2018. The researcher did “door to door” data collection by a companion of the palliative volunteer because the researcher was unfamiliar with the patients. Descriptive statistics, Kruskal-Wallis H, and simple linear regression tests were used in data analysis ( $\alpha < 0.05$ ). All data were not normally distributed so that the Kruskal-Wallis H test was used for hypothesis testing.

## Results

105 respondents participated in this study, respectively. All study respondents expressed their agreement to participate in this study, and they had signed the consent form. Most respondents were late adult married women who were housewives with low socioeconomic status. Educational background, occupational status, and Gross Domestic Product (GDP) were better in the group of breast cancer. CCS were mostly older than BCS. More single women were found to have breast cancer in this study. Table 1 below shows the demography characteristics of study respondents in detail.

**Table 1: Demography characteristic**

Characteristic	Cervical Cancer (N=47)		Breast Cancer (N=58)	
	Frequency	%	Frequency	%
1. Age (years old)				
a. < 21	0	0	1	1.72
b. 21-30	0	0	5	8.62

c. 31-40	5	10.64	10	17.24
d. 41-50	11	23.40	15	25.86
e. 51-60	17	36.17	15	25.86
f. 61-70	13	27.66	8	13.79
g. > 70	1	2.13	4	6.90
<b>2. Educational background</b>				
a. Primary school	15	31.91	11	18.97
b. Secondary school	14	29.79	5	8.62
c. High school	13	27.66	26	44.83
d. Diploma / Bachelor degree	2	4.25	15	25.86
e. Uneducated	3	6.38	1	1.72
<b>3. Marital status</b>				
a. Single	3	6.38	8	13.79
b. Married	39	82.98	36	62.07
c. Widow	4	8.51	14	24.14
d. Divorce	1	2.13	0	0
<b>4. Occupational status</b>				
a. Full-timer	2	4.25	11	18.97
b. Part-timer	3	6.38	2	3.45
c. Retired	0	0	4	6.90
d. Housewife	40	85.11	37	63.79
e. Seeking for a job	0	0	1	1.72
f. Unemployed	2	4.25	3	5.17
<b>5. GDP per month</b>				
a. Less than minimum wage	34	72.34	34	58.62
b. Minimum wage - IDR 5 million	8	17.02	14	24.14
c. More than IDR 5 million	3	6.38	6	10.34
d. No income	2	4.25	3	5.17

The majority of respondents in both groups were diagnosed before 2014, indicating they were long term survivors. The survival rate of breast and cervical cancer is particularly long. Most respondents with breast cancer undertook surgery only, while those with

cervical cancer mostly took modification of surgery and chemo-radiotherapy. There were 1.9% of respondents who possibly took an alternative therapy, and expressed a good physical condition. Table 2 below explains the primary data in detail.

**Table 2: Year of first diagnosed with cancer, and the type of received therapy**

Characteristic	Cervical Cancer (N=47)		Breast Cancer (N=58)	
	Frequency	%	Frequency	%
<b>1. Firstly diagnosed</b>				
a. 2018	0	0	4	6.90
b. 2017	7	14.89	16	27.59
c. 2016	12	25.53	7	12.07
d. 2015	5	8.62	10	17.24
e. 2014	5	8.62	3	5.17
f. < 2014	18	38.30	18	31.03
<b>2. Type of therapy</b>				
a. Surgery	5	8.62	26	44.83
b. Chemotherapy	13	27.66	8	13.79
c. Surgery + chemotherapy	2	4.25	11	18.97
d. Surgery + radiotherapy	0	0	1	1.72
e. Chemotherapy + radiotherapy	7	14.89	1	1.72
f. Surgery + chemotherapy + radiotherapy	17	36.17	5	8.62
g. Surgery + chemotherapy + radiotherapy + analgesic	1	2.13	0	0
h. Surgery + chemotherapy + radiotherapy + medicine	1	2.13	0	0
i. Surgery + chemotherapy + oral medicine	0	0	1	1.72
j. Oral medicine (various types)	0	0	4	6.90
k. Untreated	1	2.13	1	1.72

Most respondents in both groups were well-nourished (stage A), which proved by their PG-SGA score, which was similarly low. BCS was averagely heavier than CCS, with the lowest rate of weight loss in one or six months found in both groups. BMI results showed that most respondents were in their ideal state. Intake was similarly impaired in

both groups, but fortunately, there was no additional metabolic demand. CCS had more physical symptoms compared to BCS, but the results of the physical exam showed similar conditions. Most respondents were active and functioned normally. Table 3 explains the comparison of nutritional status between cases in detail.

**Table 3: Comparison of nutritional status between cases**

Characteristic	Cervical Cancer (N=47)		Breast Cancer (N=58)	
	MEAN	SD	MEAN	SD
Body weight	52.28	9.65	56.14	11.01
BMI	21.45	3.11	23.18	4.84
Intake	0.81	0.88	0.76	0.66
Symptoms	1.89	2.85	1.10	1.71
Physical exam	0.72	0.77	0.78	0.84
PGSGA score	6.49	6.20	4.97	3.84
Characteristic	Frequency	%	Frequency	%
Activities and function:				
a. Normal with no limitation	29	61.70	46	79.31
b. Not my normal self, but able to be up and about with fairly normal activities	12	25.53	10	17.24
c. Not feeling up to most things but in bed or chair less than half the day	6	12.77	0	0
d. Able to do little activity and spend most of the day in bed or chair pretty much bedridden, rarely out of bed	0	0	2	3.45
Weight loss in 1 month / 6 month:				
a. 0 – 1.9% / 0 – 1.9%	34	72.34	46	79.31
b. 2 – 2.9% / 2 – 5.9%	2	4.25	7	12.07
c. 3 – 4.9% / 6 – 9.9%	3	6.38	4	6.90
d. 5 – 9.9% / 10 – 19.9%	6	12.77	1	1.72
e. 10% or greater / 20% or greater	2	4.25	0	0
Metabolic demand:				
a. None	40	85.11	50	86.21
b. Low	5	10.64	5	8.62
c. Moderate	1	2.13	2	3.45
d. High	1	2.13	1	1.72
Nutritional status (overall):				
a. Well-nourished (stage A)	38	80.85	53	91.38
b. Moderately malnourished (stage B)	9	19.15	5	8.62
c. Severely malnourished (stage C)	0	0	0	0

In this study, we found more moderately malnourished BCS in the acute stage, while in CCS were mostly found in short and long term survivors. It is indicated that impaired nutritional status was happened earlier in

the case of breast cancer, but happened later in CCS. The nurse needs to pay more attention to nutritional needs in the BCS in the first year of diagnosis. Table 4 explains the nutritional status in all stages of survivorship for both cases in detail.

**Table 4: Nutritional status in all stages of survivorship in both cases**

Case	Survivorship Stage	Nutritional Status*	Frequency	%
Cervical cancer (n=47)	Acute (n=7)	Stage A	7	100
		Stage B	0	0
		Stage C	0	0
	Short term (n=23)	Stage A	18	78.26
		Stage B	5	21.74
		Stage C	0	0
	Long term (n=17)	Stage A	13	76.47
		Stage B	4	23.53
		Stage C	0	0
Breast cancer (n=58)	Acute (n=20)	Stage A	16	80
		Stage B	4	20
		Stage C	0	0
	Short term (n=22)	Stage A	22	100
		Stage B	0	0
		Stage C	0	0
	Long term (n=16)	Stage A	15	93.75
		Stage B	1	6.25
		Stage C	0	0

Results showed that nutritional status was not significantly different between BCS and CCS ( $p=0.116$ ), but significant differences

found in activities and function between cases ( $p=0.040$ ). Table 5 explains the comparison of nutritional status between cases in detail.

**Table 5: Comparison of nutritional status between cases**

No.	Determinant	Chi-Square	p-Value
1	Weight	3.516	0.061
2	BMI	2.188	0.139
3	Intake	0.046	0.830
4	Symptom	0.543	0.461
5	Activities and function	4.211	0.040
6	Weight loss	1.547	0.214
8	Metabolic demand	0.020	0.886
9	Physical exam	0.050	0.824

In BCS, nutritional status was not significantly different between survivorship stages ( $p=0.068$ ), which indicates that this aspect is stable/stagnant across the survival

life span in BCS. Table 6 explains the comparison of nutritional status between stages of survivorship in BCS in detail.

**Table 6: Comparison of nutritional status between stages of survivorship in BCS**

No.	Determinant	Chi-Square	p-Value
1	Weight	1.563	0.458
2	BMI	0.674	0.714
3	Intake	2.091	0.352
4	Symptom	0.747	0.688
5	Activities and function	0.366	0.833
6	Weight loss	2.700	0.259
8	Metabolic demand	2.369	0.306
	Physical exam	0.580	0.748

In CCS, nutritional status was also not significantly different between survivorship stages ( $p=0.382$ ), but the intake and physical exam were significantly different in this case ( $p=0.040$  and  $p=0.008$ , respectively) which

indicate that these two aspects change over time along with the survivorship stages in CCS. Table 7 explains the comparison of nutritional status between stages of survivorship in CCS in detail.

**Table 7: Comparison of nutritional status between stages of survivorship in CCS**

No.	Determinant	Chi-Square	p-Value
1	Weight	1.315	0.518
2	BMI	3.886	0.143
3	Intake	<b>6.461</b>	<b>0.040</b>
4	Symptom	5.797	0.055
5	Activities and function	5.392	0.067
6	Weight loss	4.210	0.122
8	Metabolic demand	4.489	0.106
9	Physical exam	<b>9.576</b>	<b>0.008</b>

BMI is the best predictor of nutritional status in BCS, which were accounted for 15.9% variance of nutritional status ( $R^2=0.159$ ), while weight loss is the best predictors of nutritional status in CCS, which were accounted for 49.6% variance of nutritional status ( $R^2=0.496$ ). Metabolic demand was the only determinant that cannot predict nutritional status in both groups

significantly. More predictors of nutritional status were found in the case of cervical cancer. Table 8 explains the influence of each determinant towards nutritional status in the BCS and CCS in detail. As the worst nutritional status may be found in short and long term survivorship in CCS, the nurse should pay attention to all possible predictors, as shown in Table 8B.

**Table 8: Predictors of nutritional status in both cases**

**A. Predictors of nutritional status in BCS**

No.	Determinant	R Square	% of Influence	p-Value
1	Weight	0.154	15.4	0.002
2	<b>BMI</b>	<b>0.159</b>	<b>15.9</b>	<b>0.002</b>
3	Intake	0.091	9.1	0.021
4	Symptom	0.000	-	0.889
5	Activities and function	0.018	-	0.320
6	Weight loss	0.003	-	0.708
8	Metabolic demand	0.012	-	0.413
9	Physical exam	0.000	-	0.947

**B: Predictors of nutritional status in CCS**

No.	Determinant	R Square	% of Influence	p-Value
1	Weight	0.262	26.2	0.000
2	BMI	0.400	40.0	0.000
3	Intake	0.232	23.2	0.001
4	Symptom	0.212	21.2	0.001
5	Activities and function	0.317	31.7	0.000
6	<b>Weight loss</b>	<b>0.496</b>	<b>49.6</b>	<b>0.000</b>
8	Metabolic demand	0.005	-	0.640
9	Physical exam	0.281	28.1	0.000

## Discussion

Results showed that overall there was no significant difference in nutritional status between BCS and CCS. Nutritional status in cancer patients has often impaired results in malnutrition induced by the tumor or by its treatment. Malnutrition in cancer could be caused by inadequate intake, less physical activity, and catabolic metabolic disorder [23]. Table 3 shows that BCS had better intake and physical activity than CCS, but the nutritional status was not significantly different between cases. This possibly

happened due to the PG-SGA score, and the global assessment categories between cases were similar in the best level for most respondents. In this study, almost all respondents were in a state of well-nourished for their nutritional status, which is very good despite the chronic disease, e.g., cancer, and the complex therapies they experienced. Although nutritional status was not significantly different between BCS and CCS, activities and functions were found to be different significantly. Table 3 shows that BCS had lesser symptoms than CCS, and

more BCS reported that they could do activities normally with no limitation than CCS. In BCS after treatment, physical activity may increase the physiology, body composition, physical functions, psychological outcomes, and QOL [24]. Physical activity is good for our health, but less activity leads to various degenerative diseases. In women, doing a regular recreational activity sustained lifetime or postmenopausal activity, and moderate or vigorous-intensity of activity can reduce the risk of breast cancer [25].

Prior study results towards BCS and CCS in communities of Surabaya showed that CCS reported more severe fatigue, pain, and sleep disturbance than BCS until then the physical wellbeing was found to be significantly different between cases [8]. By having the worst symptoms, therefore CCS reported worst activities and functions in this study. In BCS, nutritional status was not significantly different between survivorship stages, which indicate that this aspect is stable/stagnant across the survival life span in this case.

Prior study results towards BCS and CCS in communities of Surabaya showed that appetite changes are the best predictor of physical wellbeing in BCS [5]. Appetite changes may influence food intake. Table 4 shows that most BCS were well-nourished, but more moderately malnourished BCS found in the acute stage. It is indicated that acute BCS experienced worst appetite changes than the other stage of survivorship so that they had decreased intake, but this is not significant. Meaning that BCS was overall had a good and stable nutritional status across their life span. Greater body weight is a risk factor of breast cancer, especially weight gain in adulthood, which results in breast cancer in post-menopausal age[26].

Table 3 shows that BCS averagely had greater body weight than CCS, and Table 1 shows that the breast cancer-prone age in this study context is 31-60 years old. This further confirms that weight gain in adulthood increases the risk of breast cancer in later life. In CCS, nutritional status was also not significantly different between survivorship stages, but the intake and physical exam were significantly different in this case, which indicates that these two

aspects change over time along with the survivorship stages in CCS. Prior study results towards BCS and CCS in communities of Surabaya showed that CCS reported worst appetite changes, nausea-vomiting, and constipation than BCS [5]. These three aspects are determined by food intake in CCS so that this aspect change over time across the survival life span in CCS. Table 3 shows that CCS had a lower intake than BCS so that more moderately malnourished patients were found in the case of cervical cancer.

CCS was lower in weight and BMI compared to BCS, though it was still in the normal range. Table 4 shows that more short and long term CCS was moderately malnourished, which indicated that impaired nutritional status was happened later in CCS compared to BCS. Physical exam in this study includes a subjective evaluation of three aspects of body composition, such as fat, muscle, and fluid status [11]. CCS had the worst result of physical exam slightly compared to BCS. It seems that decreased intake leads to a decreased volume of fat, muscle, and fluid status in CCS.

BMI is the best predictor of nutritional status in BCS, which were accounted for a 15.9% variance of nutritional status. A study towards 450 cancer patients showed that BMI and PG-SGA score was concordance and consistent [27]. Table 3 shows that higher BMI in BCS is followed by a lower score of PG-SGA, which is good because the higher the PG-SGA score than the worst the nutritional status. Meta-analysis showed that there was an insignificant negative correlation between BMI and breast cancer risk during the premenopausal period, but the opposite situation occurred during the postmenopausal period, in which a direct and positive significant correlation found [19].

It is indicated that BMI is an important parameter to be observed continuously in women after entering adulthood. Table 8A also shows that other than BMI, weight, and intake are two significant predictors of nutritional status also in BCS, but lower in power of influence. There are only three significant predictors of nutritional status in BCS found in this study. Therefore nurse is easier in monitoring the possible changes in nutritional status in BCS just by paying



attention to BMI, weight, and intake from time to time. Weight loss is the best predictor of nutritional status in CCS, which were accounted for 49.6% variance of nutritional status. Table 3 shows that body weight and BMI were lower than BCS, although both still in the normal range. As prior study results showed that CCS reported worst appetite changes, nausea-vomiting, and constipation than BCS [8].

Therefore worst weight loss was found in CCS in this study. Table 8B shows that all aspects of PG-SGA need to be monitored continuously in CCS, except for metabolic demand, which is the only insignificant predictor of nutritional status found in this case. More significant predictors of nutritional status were found in CCS compared to BCS. Therefore health care professionals need to be more cautious towards all of these aspects.

Nurses may provide an education package to reduce the symptoms of nausea and vomiting, which related to decreased intake, especially in CCS, under chemotherapy [28] because nurses may play a cognate role by giving comprehensive health education to CCS, which is very positive[29]. By knowing this study results, hopefully, all nurses in the fields know better which aspects need to be

monitored more than the others, which is weight, BMI, and intake in BCS; and weight, BMI, intake, symptoms, activities and function, weight loss, and results of physical exam in CCS, in order to assess nutritional status periodically.

## Conclusion

Nutritional status was not significantly different between BCS and CCS, but significant differences found in activities and function between cases. In BCS, nutritional status was not significantly different between survivorship stages, which indicate that this aspect is stable/stagnant across the survival life span in this case.

While in CCS, nutritional status was also not significantly different between survivorship stages, but the intake and physical exam were significantly different in this case, which indicates that these two aspects change over time along with the survivorship stages in CCS. BMI is the best predictor of nutritional status in BCS, which were accounted for a 15.9% variance of nutritional status, while weight loss is the best predictor of nutritional status in CCS, which were accounted for 49.6% variance of nutritional status. More significant predictors of nutritional status were found in CCS compared to BCS.

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