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Nutritional Status and Health-Related Quality of Life of Breast Cancer Patients on Chemotherapy

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ABSTRACT

Introduction: Nutritional decline is typically accepted as a consequent of the course of treatment for cancer. This study aimed to (1) assess body weight status and dietary intake of breast cancer patients on chemotherapy and (2) to correlate Body Mass Index (BMI), energy and protein intake with health-related quality of life (HRQoL) profile. **Methods**: A cross-sectional study was conducted in two government hospitals in the East coast of Peninsular Malaysia using convenience sampling. Women aged ≥18 years, who were diagnosed with breast cancer and receiving chemotherapy were invited to participate. The following aspects were evaluated: body weight status, usual dietary intake (diet history) and HRQoL (EORTC QLQ-C30). Descriptive statistics and non-parametric tests were employed (SPSS 16). **Results**: Of the respondents, 41 were 49 ± 9.6 years of age; 92.7% were Malay; 97.6% (response rate = 91%) were on moderately emetogenic chemotherapy. Over half of the patients were overweight or obese (mean BMI = 25.3 ± 1.1 kg / m^2). The majority self-reported weight reduction (46.3%) but positive energy balance was detected with the current energy and protein intakes recorded at 1792.6 ± 304.9kcal / day (range= 1200-2500) and 74.5g / day (IqR= 37.7) respectively. Dietary intakes were, however, not correlated with HRQoL, but greater BMI was associated with better emotional and cognitive functioning and less fatigue. **Conclusion**: Although most patients declared losing weight, obesity and excess dietary intake were noted. Additionally, body weight status has been shown to be important in HRQoL profile, underlining the necessity for effective nutritional assessments and support to the cancer population.

Keywords: Breast cancer, nutritional status, health-related quality of life

INTRODUCTION

Chemotherapy is an important treatment in cancer care. It is commonly liable to a range of dose-related toxic effects, often incriminated in malnutrition and health-related quality of life (HRQoL) deterioration during cancer. The administration of chemotherapeutic drugs may indirectly affect food intake, absorption or use by

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inducing severe gastrointestinal symptoms such as nausea, vomiting, anorexia, abdominal pain, diarrhoea, fever, stomatitis and mucositis (Capra, Ferguson & Ried, 2001). Patients may limit their food intake to evade these gastrointestinal symptoms, thus reducing their dietary intake which may consequently result in nutrition deficiency. However, the type and severity of chemotherapy toxicity are determined by several factors such as drug type, dosage as well as treatment duration and frequency. Cancer site and the stage of malignancy have also been shown to influence the presence of these adverse effects (Capra *et al.*, 2001; Ravasco *et al.*, 2003).

In breast cancer populations, the risk of undernutrition is lower compared to patients with tumours of head-neck, gastrointestinal tract, lung or hematologic origin (high risk group) (Ravasco *et al*., 2003). Instead, weight gain is a major concern in breast cancer and it has been particularly associated with anti-neoplastic chemotherapy in the majority of studies (Del Rio *et al*., 2002; Lankester, Phillips & Lawton, 2002; Tredan *et al*., 2010) although there are several notable exceptions (Freedman *et al.*, 2004; Nissen, Shapiro & Swenson, 2011). Weight gain is predictable since excess energy intake is usually reported among breast cancer patients associated with relatively higher energy consumption or reduced physical activity during treatment (Saquib *et al*., 2007). Nevertheless, malnutrition, whether by deficit or excess, has distinct implications and bears a negative prognosis in cancer.

Essentially, HRQoL assessment is an important tool to study the impact of disease, indicate disease severity and predict treatment efficiency. In oncology, HRQoL reflects patients' general health status, which in turn is determined by a range of nutritional factors. A systematic review on the role of nutritional status in predicting HRQoL demonstrated a strong association between these two variables in the cancer population (Lis *et al*., 2012). Generally, better nutritional status has been associated with better HRQoL particularly in high-risk groups such as head-neck and gastro-intestinal cancer patients (Lis *et al*., 2012). Another study which evaluated the relationship between nutritional status and HRQoL showed that higher BMI was negatively correlated with HRQoL in gynaecological cancer patients whereby more than 70% of their respondents were either overweight or obese (Gil *et al*., 2007). Besides, findings from a study conducted among 50 non-terminal cancer population inclusive of patients with breast malignancy demonstrated that protein intake below 0.9g/kg was associated with a poorer perception of physical functioning (Trabal *et al*., 2006). Clearly, these outcomes signal the existence of relationships between nutritional parameters and HRQoL dimensions.

To date, only a few studies have addressed this area of clinical research within our local oncology settings. Furthermore, specific information on nutritional status and regular dietary intake among breast cancer patients undergoing chemotherapy is also notably lacking. Besides the present symptoms, nutritional status, dietary intake and disease or treatment-related factors may interact with one another producing a complex combination of side effects which may ultimately dictate patients' HRQoL. Although nutritional deterioration was associated with worse well-being and morbidity, there is scant evidence to support interactions between nutritional status and HRQoL among this population who are mostly reported to be overweight or obese, let alone those associated with weight gain problem. Within this framework, our preliminary study intended to (1) assess body weight status and dietary intake of breast cancer patients on chemotherapy and (2) to correlate BMI, energy and protein intake with the HRQoL profile.

METHODS

Study design and sample selection

A cross-sectional study based on convenience sampling was conducted in two government hospitals located in Terengganu and Kelantan. Permission to conduct this study was obtained from the Ministry of Health's (MOH) Research and Ethics Committee (MREC). Data collection period was from March to August 2011. The respondents included women aged 18 years and above, who were diagnosed with breast cancer at any stage and receiving chemotherapy treatment. Other inclusion criteria were they must provide consent, be able to communicate in the Malay Language (Bahasa Melayu) and understand the procedure of the study and what was required from them. The exclusion criteria were those with other malignancies or patients undergoing concurrent radiotherapy. The exclusion criteria also included any type of illness of such severity that the patient could not manage full participation in this study.

Data collection procedure

Two oncology clinics served as the patient recruitment centres for this pilot project. Following institutional board ethical approval, potential participants were identified by the research assistants for study inclusion. Each woman who had been scheduled to receive her subsequent chemotherapy treatment was invited to participate in this study. After providing written consent, patients were given instructions to complete the research quesstionnaire. The questionnaires were distributed during their routine chemotherapy treatment session with the completion being conducted under the supervision of the investigators. The questionnaires were later collected all at once.

Measurement of variables

Medical reports of the patients were reviewed to obtain demographic and medical information including biochemical data, chemotherapy regimen and breast cancer related characteristics. Only monthly household income was an exception whereby this information was self-reported by the patients.

Body weight status

Participants' current weight and height were collected from the most recently recorded values in the patients' medical chart. The weight was routinely recorded by the nurses on the day of chemotherapy administration which was also the day of study visit. Body mass index (BMI) was calculated as weight (in kilograms) divided by height (in meters) squared. The WHO classification of BMI was adapted as normal weight if BMI was 18.5-24.9kg / m^2, overweight if BMI was 25-29.9kg / m^2 and obese if BMI was $\geq$30kg / m^2 (WHO, 2000). Information on weight change history (prior to diagnosis) was self-reported by patients and was defined as the difference between the usual weight before and the weight measured after diagnosis.

Nutritional requirements and dietary assessments

Basal energy requirements were estimated based on the World Health Organisation formulae for patients aged $\leq$60 years (WHO, 1985) and Owen, Kavle & Owen (1986) for patients aged >60 years considering their better performance in predicting resting metabolic rate compared to the Harris and Benedict formula. Estimated patients' daily energy requirements (EER) were calculated by multiplying the basal requirements by a 1.2 activity factor. Daily protein requirements were estimated to range between 0.8 and 1.0g / kg per day, estimated by comparison with age standardised reference values (Food and Nutrition Board, 2002).

Usual nutritional intake (during chemotherapy treatment) was derived from their diet history. Subsequently, nutrient intakes were estimated using Nutritionist Pro®, focusing on energy and protein intake and percentage of total energy contributions (% of kcal) from fat, carbohydrate and protein. Dietary advice was not given as part of the study. Information on whether patients received dietary advice in private or at hospital was also not registered.

Health-related quality of life (HRQoL)

Patients' HRQoL was assessed using the European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30). The validity and reliability of this instrument in measuring the HRQoL of cancer patients in multicultural clinical research settings have been favourably reported by Aaronson *et al*. (1993). It is designed to be cancer specific, multi-dimensional in structure, appropriate for self-administration, applicable across a range of cultural settings and suitable for use with additional site- or treatment specific modules. The translated and validated version of EORTC QLQ C-30 in the Malay language (Yusoff, Low & Yip, 2010) has been adapted in this study. This questionnaire contains 30 items including five functional scales (physical, emotional, cognitive, social and role), three symptom scales (fatigue, pain, nausea and vomiting), a Global Health / QoL scale and six single items assessing symptoms (dyspnea, sleep disturbance, appetite loss, constipation, diarrhoea) and financial impact of disease. For the present study, most of the domains exhibited excellent internal consistencies (Cronbach's apha ranged from 0.75 to 0.99) including Global Health Status, physical functioning, role functioning, emotional functioning and nausea and vomiting. However, several exceptions were noted for fatigue, pain, cognitive functioning and social functioning in which Cronbach's apha ranged from 0.30 to 0.63, possibly due to the limited number of items in each domain (two to three items only) as well as the small sample size. Still, the overall Cronbach's alpha coefficient for this instrument was 0.78 which was considered to be reliable and adequate. The scoring of the EORTC QLQ-C30 was performed in accordance with the EORTC scoring manual. The raw scores were linearly transformed to obtain standard scores in the range of 0-100 for each of the scales and single items. A high scale score represented a higher response level. Thus, a high score for a functional scale reflected a high / healthy level of functioning and a high score for the global health status indicated a better HRQoL. Meanwhile, a high level of symptomatology / problems was presented by a high score for a symptom scale / item.

Statistical analysis

The Statistical Package for the Social Science (SPSS) Version 16.0 (SPSS Inc., Chicago IL, USA) was used for data compilation and statistical analysis. Descriptive statistics were used to assess the body weight status, dietary intake and HRQoL profile of patients. An initial normality test, carried out utilising HRQoL profile as a dependent variable, showed that normality requirement was violated (Shapiro-wilk test= $p<0.05$; data was positively skewed). Therefore, in assessing the subsequent objectives, non-parametric tests were employed. Mann-Whitney U-test was carried out to observe differences between groups for continuous data and Spearman's rho was performed to evaluate the association between two numerical variables. The probability of committing type 1 error was set at 5% level.

RESULTS

Patient characteristics

Within a period of six months, a total of 45 respondents were found to be eligible but only 41 women consented to participate (91% response rate). Reluctance to fill in the

questionnaires or refusal to be interviewed were among the reasons for non-participation in this study. Participants' age ranged from 24 to 68 years (mean = 49.1 ± 9.6). The majority were Malay, married, unemployed or housewife, and had completed secondary school. Over half of the respondents were newly diagnosed (≤ 1 years after diagnosis) with no family history of malignancy. Patients were predominantly in later stage of disease (stages three and four) and currently on moderately emetogenic chemotherapy. Patients' demographics and clinical characteristics are presented in Table 1.

Body weight status

The mean body weight for all patients at study entry was 60.3 ± 11.2 kg while the mean BMI was 25.3 ± 1.1 kg / m^2. Almost 40% of the patients were overweight and 12.2% were obese. Almost half of patients who were mostly within one year of diagnosis experienced weight reduction (46.3%). Of note, weight gain was also reported by 19.5% of the patients.

Nutritional requirement and dietary intake

Table 2 shows details on macronutrients, fruits and vegetables intake of breast cancer patients receiving chemotherapy. The estimated energy requirement for this cohort was 1606.6 ± 132.4 kcal / day and the protein median reference value was 58.0g / day. Despite being on chemotherapy, 70% of the patients were meeting more than their individual daily energy requirements. The current patients' energy intake was 1792.6 ± 304.9kcal / day (range= 1200-2500) while the median protein intake was 74.5g / day. Both energy and protein intakes were significantly higher than their respective reference values (p= 0.001). On average, patients reported resuming their normal intake by the forth day post-chemotherapy. For macronutrient analysis, the intake was within the acceptable range for carbohydrate (47.7%; acceptable range= 55-70%) and fat intake (26.1%; acceptable range = 20-30%) except for protein (24.9%; acceptable range= 10-15%) which was in excess. In assessing the fruits and vegetable intake, only 31.7% achieved the recommended daily servings.

HRQoL: Association with BMI, energy and protein intake

Bivariate correlations were conducted between BMI, energy and protein intake with each HRQoL subscale. Of note, the results demonstrated that both energy and protein intake were not correlated with HRQoL. The only significant findings were detected between BMI and several HRQoL subscales (Table 3). BMI was positively correlated with emotional and cognitive functioning (r_s= 0.421, p=0.006 and r_s =0.312, p=0.047 respectively) but negatively correlated with fatigue (r_s =-0.345, p=0.027). In particular, greater BMI was associated with better emotional and cognitive functioning. Inversely, higher patients' BMI correlated with less fatigue. Additionally, when comparing these two BMI groups, the only subscale with significant difference was emotional functioning, which was poorer in patients with normal BMI (33, IqR 68.8) compared to those who were overweight or obese (71, IqR 52.1). The results also demonstrated that overweight or obese patients experienced better cognitive functioning and reported lower symptom scores (less intense) particularly for fatigue and insomnia (Table 3).

Due to the limited associations between nutritional-related variables and HRQoL, other potential significant factors such as socio-demographic variables (age, marital and financial status and employment) and stage of disease were additionally evaluated. The data revealed that although there was no correlation between age and HRQoL, married women experienced significantly better HRQoL and less fatigue (p<0.05). Patients with lower income also significantly

Table 1. Patient demographics and clinical characteristics

Characteristics	*Frequency (n=41)*	*Percentage (%)*
Age (mean ± sd*)	49.1 ± 9.6 years	
20-39 years	5	12.2
40-59 years	32	78.0
60-79 years	4	9.8
Ethnicity		
Malay	38	92.7
Chinese	3	7.3
Marital Status		
Married	31	75.6
Single/ widowed	10	24.4
Education level		
Never attended school	4	9.8
Primary	5	12.2
Secondary	26	63.4
Tertiary	6	14.6
Occupation		
Employed	19	46.3
Housewife/Unemployed	22	53.7
Monthly household income		
<RM 1000	11	26.8
≥RM 1000	30	63.2
Current BMI (mean ± sd*)	25.3 ± 4.5 kg/m^2	
Underweight	1	2.4
Normal	19	46.3
Overweight	16	39.1
Obese	5	12.2
Self-reported weight change		
Loss	19	46.3
Gain	8	19.5
Stable	14	34.2
Years after diagnosis		
≤1 years	30	73.2
> 1 years	11	26.8
Family history of malignancy		
Yes	12	29.3
No	29	70.7
Stages of breast cancer		
1 & 2	19	46.3
3 & 4	22	53.7
Chemotherapy emetogenicity		
Moderately	40	97.6
Highly	1	2.4

* sd= standard deviation

Table 2. Energy balance, macronutrient, fruit and vegetable intake of respondents (n=41)

Dietary intake	*Mean (sd)*	*Median (IqR)*
Energy (kcal)	1792.6 (304.9)	
Protein (g)		74.5 (37.7)
% of energy		24.9 (9.4)
Carbohydrate (g)		229.4 (111.3)
% of energy		47.7 (12.3)
Fat (g)		55.6 (26.2)
% of energy		26.1 (12.8)
Dietary fibre (g)		6.6 (6.9)
Fruits (serving / day)		2.0 (2.0)
Vegetables (serving / day)		2.0 (1.0)
% eating five or more servings / day		31.7

Table 3. EORTC QLQ-C30 subscale scores related to BMI

Scale/Item	*Correlation*			*Comparison between groups*		
	Median (IqR)	*Correlation coefficient,* r_s	*p-value*	*Median (IqR)*		*p-value*[#]
				Normal (n=19)	*Overweight/ Obese* (n=21)	
BMI (kg / m^2)	25 (6.9)	-				
*Global health status	50 (16.7)	0.218	0.170	50 (33.3)	50 (16.7)	0.106
*Functioning						
Physical functioning	80 (14.5)	0.105	0.515	80 (26.7)	80 (13.9)	0.956
Role functioning	67 (33.3)	0.155	0.332	67 (54.2)	67 (20.8)	0.351
Emotional functioning	67 (66.7)	0.421	0.006[a]	33 (68.8)	71 (52.1)	0.008[a]
Cognitive functioning	83 (25.0)	0.312	0.047[a]	83 (33.3)	100 (16.7)	0.095
Social functioning	100 (0.0)	0.040	0.803	100 (0.0)	100 (0.0)	0.269
[†]Symptoms / items						
Fatigue	33 (30.5)	-0.345	0.027[a]	39 (44.3)	33 (22.0)	0.189
Nausea and Vomiting	0 (0.0)	0.013	0.937	0 (4.2)	0 (4.2)	0.867
Pain	33 (33.3)	-0.241	0.129	33 (20.8)	33 (20.8)	0.099
Dyspnoea	0 (0.0)	-0.207	0.194	0 (8.3)	0 (0.0)	0.204
Insomnia	0 (66.7)	-0.078	0.629	17 (66.7)	0 (66.7)	0.417
Appetite loss	0 (33.3)	0.002	0.988	0 (33.3)	0 (33.3)	0.718
Constipation	0 (33.3)	-0.017	0.916	0 (66.7)	0 (33.3)	0.706
Diarrhoea	0 (0.0)	-0.244	0.124	0 (66.7)	0 (0.0)	0.066
Financial difficulties	0 (0.0)	-0.174	0.278	0 (8.3)	0 (0.0)	0.755

* Score range 0-100 = higher score indicates better HRQoL
† Score range 0-100 = higher score indicates worse HRQoL
# Man-Whitney test; [a] significant at $p<0.05$

reported more financial difficulties compared to those with higher income. Housewives and unemployed respondents possessed better HRQoL than their counterparts ($p<0.05$). Essentially, emotional functioning was significantly poorer in patients with locally advanced disease (stages 3 and 4 of breast cancer).

DISCUSSION

In a population of breast cancer patients who actively received chemotherapy, the current body weight status and dietary intake were evaluated. Consistent with previous studies conducted among breast cancer survivors (Saquib *et al*., 2007; Yong *et al*., 2011), the mean body weight and BMI were rather similar to our sample, with over half being overweight or obese although their patients had much longer years of survival (within 4 years since diagnosis). Notably, this condition was expected since the phenomenon of overweight and obesity were already prevalent in women prior to diagnosis (Yong *et al*., 2011) and was further aggravated by weight gain problems after treatment (Del Rio *et al*., 2002; Tredan *et al*, 2010. Although some patterns with weight gain were commonly observed post-diagnosis of breast cancer (Yong *et al.*, 2011; Saquib *et al.*, 2007), weight loss was more prevalent in our study population. It was possible that being on active treatment had contributed to this finding, which was supported by previous evidence demonstrating that 60% of women with breast cancer experienced a small initial weight loss during chemotherapy (Freedman *et al*., 2004). Self-reported data without actual weight change magnitude from patients who may have heightened anxiety due to being newly diagnosed and commencement of chemotherapy may, however, potentially cause an increase in the proportion of reported weight loss incidence. Nevertheless, in a study with larger samples, weight gain was still prominent among patients during chemotherapy treatment (Lankesterf *et al.*, 2002). Hence, other observational studies are required to include a larger pool of representatives among our local breast cancer population during their active treatment to substantiate this early finding and identify the nutritional provisions required.

A positive energy balance was denoted during the course of chemotherapy in patients with breast cancer. Increases in dietary intake associated with chemotherapy have previously been reported in this population (Harvie *et al.*, 2005). The increases in dietary intake were particularly observed during mid-treatment cycles (Harvie *et al.*, 2004) which may be related to our sample, who were mostly in the second and third chemotherapy cycles (>50% of respondents). Chemotherapy-associated hungers, increased sense of well-being or increased snacking to offset nausea were thought to be the contributory factors for such patterns (Grindel, Cahill & Walker, 1989). Additionally, it is of interest to compare our baseline dietary intake values to other studies. Reasonable concordance of mean energy intake was found between our results and other published data among women diagnosed with breast cancer (Harvie *et al.*, 2004; Saquib *et al*., 2007). However, compared to published values from a local study among 368 breast cancer survivors (Yong *et al.*, 2011), the energy intake of our patients was much higher, by 400 kcal per day. While being the reference point, the data from this study may not be entirely comparable to the present findings due to differences in the study cohort, dietary assessment methods, and sample size. Nevertheless, favourable comparisons to other published data coupled with the use of a precise and relatively unbiased measure of diet have assured the comparability of these baseline results to some degree.

Further exploration on dietary patterns revealed encouraging evidence in terms of

meeting the dietary guidelines in comparison with the current public guidelines. In particular, the appropriate range of daily calories from each micronutrient was achieved except for excess in protein intake; this was similar to the previous findings among the local breast cancer population (Yong *et al*., 2011). Consistent with the intakes observed in breast cancer survivors (Harvie *et al.*, 2004; Wayne *et al.*, 2004), most of our respondents met their daily energy requirements with some even exceeding 120% of their requirement. In addition, the intake of fruits and vegetables was reported to be higher compared to a previous study (Yong *et al*., 2011). Nonetheless, the tendency for over-reporting of these food items could be prominent because being overweight and diagnosed with breast cancer may have prompted women to over-report healthy behaviour (Yong *et al.*, 2011). Although there was improved intake of fruits and vegetables, it should be noted that the intake was still below the general recommendation, with only a small proportion of the current sample meeting the recommended servings per day. In comparison to the previous studies, 75.5% of Malaysian women aged 25 to 64 years did not meet the dietary guidelines for fruits and vegetable intake (MOH, 2006) as supported by our study findings. Despite fulfilling some recommendations of the Malaysian Dietary Guidelines (MDG) (National Coordinating Committee on Food and Nutrition, 2010), women with breast cancer were expected to adhere more to these healthy nutritional practices considering their current substandard health conditions.

Additionally, in an attempt to explore the association between nutritional-related variables and HRQoL, the results revealed that neither energy nor protein intakes were statistically significantly correlated with HRQoL profile. However, in a larger sample involving 285 gastric cancer patients, a clear correlation between reduced food intake and HRQoL was found to exist (Tian & Chen, 2005). Some studies even suggest that dietary intake accountfor 20% of the HRQoL profile (Ravasco *et al*., 2004). Even so, it should be noted that different cancer types or locations may impart different nutritional patterns. In high risk groups comprising of head-neck or gastrointestinal tract cancer patients, energy intake was significantly correlated with several functional outcomes as well as symptoms such as anorexia and fatigue. In contrast, nutritional parameters were not significantly correlated with HRQoL dimensions in low risk group inclusive of breast cancer patients (Ravasco *et al*., 2003).

The last part of exploratory analysis from our current study examining the relationship between BMI and HRQoL demonstrated positive correlations particularly in Emotional and Cognitive Functioning but a negative correlation with Fatigue. Perhaps being at higher BMI would make patients perceive that they have a lower risk of nutritional depletion related to cancer diagnosis and treatments, thus resulting in better HRQoL. However, considering the fact that obesity has been consistently associated with reduced survival rate and cancer recurrence after antineoplastic therapy and / or surgery (Chaves *et al*., 2010), intensive nutritional interventions to address these issues and to prevent weight gain are indeed essential. The impact of nutritional factors on HRQoL in the present sample may be subtle and indirect assuming that other major HRQoL determinants like psychosocial factors are more pertinent for a breast cancer population (Montazeri, 2008). Descriptions on the HRQoL and its various dimensions among this study population have been previously reported demonstrating that patients' HRQoL was impaired by the psychological distress particularly with regard to role functioning and emotional functioning *(*Lua, Salihah & Mazlan, 2012). Predictive models of HRQoL in a population-based, multiethnic sample of women with breast carcinoma also showed that socio-ecological factors in

conjunction with medical characteristics were more salient to HRQoL outcomes in which cancer-related medical factors (age at diagnosis, cancer stage, radiation therapy), health status and psychological context account for 60% of the variance in HRQoL (Kimlin *et al.*, 2007).

When interpreting our findings, some limitations should be noted. One potential restriction might be caused by limited sample size and recruitment through only two study centres (non-random sampling) which might therefore not be entirely representative of all chemotherapy breast cancer patients. Still, our study sample has generated preliminary evidence on current body weight status and dietary intake of this cohort to serve as a basis for future research. Another possible drawback involved the self-report nature of the outcome measures including dietary intake and weight change which may have influenced the results. Using additional objective measures in a larger sample to replicate these findings should be more beneficial to provide a comprehensive baseline data for future trials. The introduction of appropriate biomarker measurements may also help in the validation of self-reported data in the near future. Furthermore, the adoption of cross-sectional design does not allow for documentation of the outcome changes over time or to make any inference about the causal relationships between nutritional-related variables and HRQoL. Future prospective longitudinal studies are needed to better understand the causal association, if any, between nutritional-related variables and HRQoL.

Unlike previous studies, the present study highlighted a limited number of breast cancer patients receiving chemotherapy who experienced weight gain. Instead, the majority have lost weight during their adjuvant treatment sessions. However, it is important to note that obesity remains a concern since over half of the patients were overweight or obese and positive energy balance was denoted among this cohort. Intensive weight management interventions to maintain healthy weight, coupled with comprehensive nutritional assessment and follow-up for malnutrition risk identification are particularly required. Furthermore, body weight status has been shown to be important in HRQoL profile of these patients. Still, the association between these nutritional-related variables and HRQoL warrant further investigation to provide concrete reasoning for the observation. Larger scale studies in multiple oncology settings could be the way forward, hence providing patient-centred solutions for optimal nutrition-sensitive treatments in the future.

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REFERENCES

Aaronson NK, Ahmedzai S, Bergman B, Bullinger M, Cull A, Duez NJ, Filiberti A, Flechtner H, Fleishman DB, De Haes JCJM, Kaasa S, Klee M, Osoba D, Ravazi D, Rofe P, Schraub S, Sneeuw K, Sullivan M & Takeda F (1993). The European Organization for Research and Treatment of Cancer QLQ C30: A quality of life instrument for use in international clinical trials in oncology. *J Natl Cancer Inst* 85: 365-76.

Capra S, Ferguson M & Ried K (2001). Cancer: Impact of nutrition intervention outcome - Nutrition issues for patients. *Nutrition* 17: 769-772.

Chaves MR, Boleo-Tome C, Monteiro-Grillo I, Camilo M & Ravasco P (2010). The diversity of nutritional status in cancer: New insights. *Oncologis*t 15: 523-530.

Del Rio G, Zironi S, Valeriani L, Menozzi R, Bondi M, Bertolini M, Piccinini L, Banzi MC, & Federico M (2002). Weight gain in women with breast cancer treated with adjuvant cyclophosphomide, methtrexate and 5-flourouracil. Analysis of resting energy expenditure and body composition. *Breast Cancer Res Treat* 73: 267-273.

Food and Nutrition Board (2002). Dietary Reference Intakes for Energy, Carbohydrates, Fiber, Fat, Protein and Amino Acids (Macronutrients). National Academy Press, Washington DC.

Freedman RJ, Aziz N, Albanes D, Hartman T, Danforth D, Hill S, Sebring N, Reynolds JC & Yanovski JA (2004). Weight and body composition changes during and after adjuvant chemotherapy in women with breast cancer. *J Clin Endocrinol Metab* 89: 2248-2253.

Gil KM, Gibbons HE, Jenison EL, Hopkin MP & von Gruenigen VE (2007). Baseline characteristics influencing quality of life in women undergoing gynaecologic oncology surgery. *Health Qual Life Outcomes* 5: 25-25.

Grindel CG, Cahill CA & Walker M (1989). Food intake of women with breast cancer during their first 6 months of chemotherapy. *Oncol Nurs Forum* 16: 401-407.

Harvie MN, Campbell IT, Baildam A & Howell A (2004). Energy balance in early breast cancer patients receiving adjuvant chemotherapy. *Breast Cancer Res Treat* 83: 201-210.

Harvie MN, Howell A, Thatcher N, Baildam A & Campbell I (2005). Energy balance in patients with advanced NSCLC, metastatic melanoma and metastatic breast cancer receiving chemotherapy - a longitudinal study. *British J Cancer* 92(4): 673-680.

Kimlin T, Ashing-Giwa, Tejero JS, Kim J, Padilla GV & Hellemann G (2007). Examining predictive models of HRQOL in a population-based, multi-ethnic sample of women with breast carcinoma. *Qual Life Res* 16(3): 413-428.

Lankesterf KJ, Philips JE & Lawton PA (2002). Weight gain during adjuvant and neoadjuvant chemotherapy for breast cancer: an audit of 100 women receiving FEC or CMF chemotherapy. *Clin Oncol* 14(1): 64-67.

Lis CG, Gupta D, Lammersfeld CA, Markman M & Vashi PG (2012). Role of nutritional status in predicting quality of life outcomes in cancer – A systematic review of the epidemiological literature 11:27 doi:10.1186/1475-2891-11-27.

Lua PL, Salihah NZ & Mazlan NM (2012). Health-related quality of Life profile in relation to chemotherapy-induced nausea and vomiting among breast cancer patients. *ASEAN J Psychiatr* 13(1): 3-12.

MOH (2006). My NCDS-1. Malaysia NCD Surveillance-1 2005/2006. NCD Risk Factors in Malaysia. Ministry of Health Malaysia, Putrajaya.

Montazeri A (2008). Health-related quality of life in breast cancer patients: A bibliographic review of the literature from 1974 to 2007. *J Exp Clin Cancer Res* 27(1): 32.

National Coordinating Committee on Food and Nutrition. (2010). Malaysian Dietary Guidelines. Ministry of Health Malaysia, Putrajaya.

Nissen MJ, Shapiro A & Swenson KK (2011). Changes in weight and body composition in women receiving chemotherapy for breast cancer. *Clin Breast Cancer* 11(1): 52-60.

Owen OE, Kavle E & Owen RS (1986). A reappraisal of the caloric requirements in healthy women. *Am J Clin Nutr* 44: 1-19.

Ravasco P, Monteiro-Grillo I, Vidal PM & Camilo ME (2003). Nutritional deterioration in cancer: the role of disease and diet. *Clin Oncol* 15: 443-450.

Ravasco P, Monteiro-Grillo I, Vidal PM & Camilo ME (2004). Cancer: disease and nutrition are key determinants of patients' quality of life. *Support Care Cancer* 12: 246-252.

Saquib N, Flatt SW, Natarajan L, Thomson CA, Bardwell WA, Caan B, Rock CL & Pierce JP (2007). Weight gain and recovery of pre-cancer weight after breast cancer

treatments: evidence from the women's healthy eating and living (WHEL) study. *Breast Cancer Res Treat* 105: 177-186.

Tian J & Chen JS (2005). Nutritional status and quality of life of the gastric cancer patients in Changle county of China. *World J Gastroenterol* 11(11): 1582-1586.

Trabal J, Leyes P, Forga MT & Hervas S (2006). Quality of life, dietary intake and nutritional status assessment in hospital-admitted caner patients. *Nutr Hosp* 21: 505-510.

Tredan O, Bajard A, Meunier A, Roux P, Fiorletta I, Gargi T, Bachelot T, Guastalla JP, Lallemand Y, Faure C, Perol D & Bachmann P (2010). Body weight change in women receiving adjuvant chemo-therapy for breast cancer: A French perspective study. *Clin Nutr* 29: 187-191.

Wayne SJ, Lopez ST, Butler LM, Baumgartner KB, Baumgartner RN & Ballard-Barbash R (2004). Changes in dietary intake after diagnosis of breast cancer. *J Am Diet Assoc* 104(10: 1561-1568).

WHO (1985). Energy and Protein Requirements (Technical Report Series). World Health Organization, Geneva.

WHO (2000). Obesity: Preventing and Managing the Global Epidemic. Report of a WHO Consultation on Obesity. World Health Organization, Geneva.

Yong HY, Zalilah MS, Kandiah M, Chan YM, Rokiah MY, Zabedah O, Nurfaizah S, Yong HW & Zalina H (2011). Weight changes and lifestyle behaviours in women after breast cancer diagnosis: a cross-sectional study. *BMC Public Health* 11: 309.

Yusoff N, Low WY & Yip CH (2010). The Malay version of the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC-QLQ C30): reliability and validity study. *Int Med J Malaysia* 9(2): 45-50.