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Factors Associated with Energy and Protein Intake Among Breast Cancer Patients in National Cancer Institute

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Abstract

Breast cancer is a growing global burden affecting millions of women worldwide. Adequate energy and protein intake are fundamental for optimal recovery, as insufficient intake can lead to various complications. ESPEN Practical Guidelines for Cancer Patients (2021) recommend energy and protein intake ranging between 25-30 kcal/kg/day and 1.0 g/kg/day respectively. Therefore, this study aims to investigate the factors associated with energy and protein intake among breast cancer patients at the National Cancer Institute in Putrajaya. **Methods:** Sociodemographic characteristics, anthropometry data, medical characteristics, handgrip strength, and food history were collected from 32 Malaysian outpatients aged 18 and above using medical history and self-administered questionnaires. Outpatients with chronic diseases and those in other research studies were excluded. Energy and protein intake were analyzed using Nutritionist Pro Software, while IBM SPSS version 27 was used for data analysis. **Results**: Majority of respondents had adequate protein and energy intake. Statistically significant associations were observed between age ($X^2 = 4.937$, $p = 0.04$), Body Mass Index ($X^2 = 8.312$, $p = 0.01$) and energy intake. **Conclusion:** This study provides insights into the nutritional status of breast cancer patients and emphasizes the significance of addressing specific factors that can influence energy and protein intake.

Keywords: Breast cancer, energy intake, protein intake, energy adequacy, protein adequacy, cancer patients

Introduction

Affecting one in nineteen Malaysian women, breast cancer appears to be the most common cancer in Malaysia (Lee et al., 2019). The rising prevalence of breast cancer is widely recognized and its burden has been increasing around the globe, especially in transitioning

countries (Arnold et al., 2022). Although there are genetic risk factors related to breast cancer, it has been seen that only 5-10% of all cancers are attributed to genetic defects, while the remaining 90-95% are attributed to lifestyle and environment (Anand et al., 2008). Lifestyle and environmental factors are potentially modifiable; therefore, they become a focus for a preventive strategy for breast cancer (Suárez-Varela et al., 2018). In addition, poor dietary intake, and excess body fat, are also included as modifiable risk factors for breast cancer. Jamhuri et al. (2017) found that food waste was high among cancer patients, which indicates that there was inadequate energy intake among cancer patients. The preceding research also revealed that the estimated loss of energy and protein values from wasted food has a significant influence on patients' ability to meet their dietary requirements (Zaid et al., 2019). There has been some discrepancy in previous research on how diets of breast cancer patients undergoing chemotherapy changed. They either indicated increases, reductions, or no changes in energy intake during chemotherapy (De Vries et al., 2017). Besides, breast cancer patients had a significantly lower energy intake than women without cancer, which is due to them experiencing post-chemotherapy symptoms such as lower self-reported taste, lower appetite, nausea, less hunger, dry mouth, and difficulty chewing which limit the enjoyment of eating (De Vries et al., 2017). Women with breast cancer are at risk for malnutrition in addition to having problems with their quality of life and being physically active. Malnutrition in cancer patients may come from increased protein and energy needs, as well as reduced intake, brought on by the tumor itself as well as/or treatment-related adverse effects (Parkinson et al., 2023). Hence, it is important to investigate the adequacy of energy and protein intake among breast cancer patients.

To maintain an adequate nutritional state, cancer patients' energy consumption should range between 25 and 30 kcal/kg/day, while protein intake should be above 1g/kg/day, and if feasible, up to 1.5 g/kg/day (Muscaritoli et al., 2021). While various studies have been conducted in other countries examining this relationship, there has been a lack of research focused on the Malaysian population. A greater knowledge of the potential role of diet in breast cancer risk should guide preventative and treatment efforts in this country. Therefore, this study aims to investigate the factors associated which includes sociodemographic characteristics, anthropometry data, medical characteristics and handgrip strength with energy and protein intake among breast cancer patients at the National Cancer Institute in Putrajaya, Malaysia.

Materials and Methods

Participants and Study Design

This study implemented cross-sectional study design and was conducted from end of March 2023 until early May 2023 at the Oncology Clinic, National Cancer Institute, Putrajaya after getting approval from Medical Research and Ethics Committee (MREC) and Clinical Research Centre (CRC) of National Cancer Institute, Putrajaya. The number of participants in this study were 32 and participants were filtered according to inclusion and exclusion criteria. All recruited participants were outpatients that are Malaysian, aged 18 years old and above, and able to communicate verbally. Outpatients with chronic diseases and participated in another research study were excluded from participating in this study.

Questionnaire

Participants were provided with a physical questionnaire available in both Bahasa Melayu and English versions. The questionnaire aimed to collect information on their sociodemographic characteristics and medical characteristics. Anthropometry measurements were gathered from the participants' medical records or computer system.

Handgrip Strength Measurement

The participants' handgrip strength were assessed using a dynamometer. Grip strength was measured in a standing position with the elbow flexed at 90. The handgrip strength was measured in the dominant hand, and the protocol involved the performance of three measurements for each side with registration of the mean value obtained. During testing, the participant was strongly encouraged to exhibit the best possible force. Handgrip strength below 18 kg/force were regarded as low reading (Chen et al., 2020).

Energy and Protein Intake

Food Frequency Questionnaire (FFQ) which was adapted from the Malaysian Adults Nutrition Survey (MANS), were used in this study (Institute for Public Health, 2014). The respondents were requested to fill in the serving size of each food that they consumed. Each food listed was given a standard serving size based on the Atlas of Food Exchanges and Portion Sizes (Suzana et al., 2015) and also the list of food item weight in household measures. To calculate the amount of food consumed per day, the following formula will be used: Amount of food (g) per day = frequency of intake (conversion factor) (Table 1) x serving size x total number of servings x weight of food in one serving. A computerized local dietary analysis program, Nutritionist Pro version 2.0 (First Data Bank, The Hearst Corp. United States of America [USA]), was used to analyze the nutrient intakes of the patients.

Statistical Analysis

Data was analysed by using IBM SPSS version-27 software with the significance level set at $p<0.05$. The normality distribution was evaluated to set the test of parametric or non-parametric. Descriptive data was analysed through univariate analysis. The result for categorical variables was presented in frequencies and percentages while the result for continuous variables was presented in mean and standard deviation. Chi-square test was used to test the association between sociodemographic characteristics, anthropometry data, medical characteristics and handgrip strength with energy and protein intake adequacy.

Ethical Considerations

Ethical approval of this research was obtained from the Medical Research and Ethics Committee (MREC), Kementerian Kesihatan Malaysia, under reference 22-00219-FBX(4). Additionally, an endorsement was requested from the Clinical Research Centre (CRC) of the National Cancer Institute, Putrajaya. A temporary pass application was granted, identified as CRC.IKN/760-2/4/1 JLD.2 (55), prior to the initiation of data collection at the National Cancer Institute, Putrajaya. This data collection phase took place between April 2023 and May 2023. Informed consent was obtained from all participants before their involvement in the study. Participants were provided with comprehensive information about the study's purpose and procedures. All data collected were handled with strict confidentiality and access was restricted to authorized research personnel only.

Results

Sociodemographic characteristics of respondents

The age range of the participants was between 33 and 67 years old. The majority of the participants were below the age of 65. In terms of ethnicity, the respondents were predominantly Malay (84.4%), followed by Chinese (9.4%) and Indians (6.3%). With regards to marital status, the majority of respondents were married (81.3%), followed by widows (15.6%) and singles (3.1%). The educational background of the respondents varied, with the majority having secondary education (53.1%), while 34.4% had tertiary education, and the remaining respondents had primary education. In terms of employment status, a majority of the respondents were unemployed (56.3%). Furthermore, almost every respondent had a household income below RM2500 (46.9%), while some fell within the range of RM4850 to RM10959 (28.%), and the smallest majority had a household income exceeding RM10959 (9.4%).

Table 1
Sociodemographic Characteristics of Respondents (N = 32)

Characteristics	n (%)	Mean ±SD	Characteristics	n (%)	Mean ±SD
Age, year		52.34 ± 8.15	**Employment Status**		
25 – 54	16 (50)		Government office	4 (12.5)	
55 – 64	15 (46.9)		Private sector	3 (9.4)	
65 and above	1 (3.1)		Businessman	2 (6.3)	
Ethnic			Employed	5 (15.6)	
Malay	27 (84.4)		Unemployed	11 (34.4)	
Chinese	3 (9.4)		Retired	1 (3.1)	
Indian	2 (6.3)		Others (Housewife)	6 (18.8)	
Educational level			**Household income**		1.47 ± 0.67
No formal education	0 (0)		< RM 2500	20 (62.5)	
Primary education	4 (12.5)		RM 4850 - RM 10959	9 (28.1)	
Secondary education	17 (53.1)		> RM 10959	3 (9.4)	
Tertiary education	11 (34.4)				
Marital Status					
Single	1 (3.1)				
Married	26 (81.3)				
Divorced	0 (0)				
Widow	5 (15.6)				

SD = Standard deviation

Anthropometry measurements of the respondents

The average height was measured at 154.59 ± 5.22 cm, ranging from 144 cm to 169 cm. The weight of the participants ranged from 44 kg to 95 kg, with an average of 67.93 ± 12.146 kg. Additionally, the Body Mass Index (BMI) ranged from 19.50 kg/m² to 39.50 kg/m², with a mean value of 28.49 ± 5.12 kg/m². Majority of participants fall in category of overweight (46.9%), followed by normal (28.15%), obese class II (12.5%), obese class 1 (9.4%) and underweight (3.1%).

Table 2
Anthropometry Measurements of Respondents (N = 32)

Characteristics	n (%)	Mean ± SD
Weight (kg)		67.93 ± 12.15
Height (cm)		154.59 ± 5.22
Body Mass Index Classification (kg/m²)		28.49 ± 5.12
Underweight, <18.5, <24 for elderly	1 (3.1)	
Normal, 18.5 - 24.9, 24 - 30 for elderly	9 (28.1)	
Overweight, 25.0 - 29.9, > 30 for elderly	15 (46.9)	
Obese class I, 30.0 - 34.9	3 (9.4)	
Obese class II, 35.0 - 39.9	4 (12.5)	

SD = Standard deviation

Medical Characteristics of Respondents

Among the 32 participants, 14 (43.8%) were new cases with no previous treatment. Chemotherapy was administered to 17 participants (53.1%), while 15 participants (46.9%) did not receive chemotherapy. Similarly, 17 participants (53.1%) underwent surgery, while the remaining 15 (46.9%) did not. Regarding radiotherapy, 17 participants (53.1%) received this treatment, while 15 participants (46.9%) did not. Additionally, 18 participants (56.3%) were in the "Finished and follow-up" category. In terms of cancer stage, the majority of participants (46.9%) were at Stage III, followed by 28.1% at Stage II, 12.5% at Stage IV, and 9.4% at Stage I. The duration of diagnosis ranged from less than 1 year for 13 participants (40.6%) to less than 2 years for 2 participants (6.3%), and less than 5 years for 11 participants (34.4%). Furthermore, 6 participants (18.8%) had been diagnosed for more than 5 years.

Table 3
Medical Characteristics of Respondents (n = 32)

Variables	n (%)	Mean ±SD	Variables	n (%)	Mean ±SD
Clinical treatment			**Cancer stage**		
No treatment (New case)	14 (43.8)		Stage I	3 (9.4)	
Chemotherapy			Stage II	9 (28.1)	
Yes	17 (53.1)		Stage III	15 (46.9)	
No	15 (46.9)		Stage IV	4 (12.5)	
Surgery			**Duration of diagnosis, year**		2.31 ± 1.203
Yes	17 (53.1)		<1 year	13 (40.6)	
No	15 (46.9)		< 2 years	2 (6.3)	
Radiotherapy			< 5 years	11 (34.4)	
Yes	17 (53.1)		Others (>5 years)	6 (18.8)	
No	15 (46.9)				
Others (Finished and follow up)	18 (56.3)				

SD = Standard deviation

Handgrip Strength of Respondents

It was found that 71.9% of participants had low hand grip strength, falling below the threshold of 18 kg/force. On the other hand, 28.1% of participants had normal hand grip strength, which is defined as ≥ 18 kg/force.

Table 4
Handgrip strength of respondents (n = 32)

Characteristics	n (%)	Mean ± SD
Hand grip strength, kg		14.12 ± 4.84
Hand grip strength (Dominant), kg		
Normal (≥ 18 kg/force)	9 (28.1)	
Low (< 18 kg/force)	23 (71.9)	

SD = Standard deviation

Energy and protein intakes of respondents

Among the participants, 78.1% were categorized as having adequate energy intake, with a total of 25 individuals falling into this category. Conversely, 21.9% of participants had inadequate energy intake, comprising a total of 7 individuals. With regard to protein adequacy, 56.3% of participants were classified as having adequate protein intake, with a total of 18 individuals falling into this category. On the other hand, 43.8% of participants had inadequate protein intake, with a total of 14 individuals falling into this group.

Table 5
Energy and protein intakes of respondents (n = 32)

Characteristics	n (%)	Mean ± SD	Characteristics	n (%)	Mean ± SD
Total energy intake (kcal/kg/day)		1893 ± 605	**Total protein intake(g/kg/day)**		63.6 ± 23.80
Energy adequacy status			**Protein adequacy status**		
Adequate (Above 25 kcal/kg/day)	25 (78.1)		Adequate (Above 1 g/kg/day)	18 (56.3)	
Inadequate (Below25 kcal/kg/day)	7 (21.9)		Inadequate (Below 1g/kg/day)	14 (43.8)	

SD = Standard deviation

Association of Sociodemographic Characteristics, Anthropometry Data, Medical Characteristics and Handgrip Strength With Energy Intake

Regarding sociodemographic characteristics, age showed a statistically significant association with energy intake ($X^2 = 4.937$, $p = 0.047$*). Respondents between 18 and 60 years old had 87.5% with adequate energy intake, while those above 60 years had 50% with adequate energy intake. Ethnicity, marital status, educational level, employment status and household income did not demonstrate a significant association with energy intake. Anthropometry data, particularly body mass index (BMI), showed a significant association with energy intake ($X^2 = 8.312$, $p = 0.01$*). Participants with normal BMI had 44.4% adequate energy intake, whereas those with abnormal BMI had a higher percentage of 91.3 with adequate energy intake. Besides, medical characteristics and handgrip strength, specifically the dominant hand, did not reveal significant associations with energy intake.

Table 6

Association of Sociodemographic Characteristics, Anthropometry Data, Medical Characteristics And Handgrip Strength With Energy Intake (N = 32)

Variables	Energy intake		X^2	*p*-value
	Adequate (25 - 30 kcal/kg/day)	Inadequate (< 25 kcal/kg/day)		
Sociodemographic characteristics				
Age,years			4.937	[a]0.047*
18 - 60	21 (87.5)	3 (5.3)		
Above 60	4 (50.0)	4 (50.0)		
Ethnic			0.012	[a]1.00
Malay	21 (77.8)	6 (22.2)		
Non-malay	4 (80.0)	1 (20.0)		
Marital status			0.567	[a]0.59
Married	21 (80.8)	5 (19.2)		
Unmarried	4 (66.7)	2 (33.3)		
Educational level			1.603	[a]0.37
Primary & secondary	15 (71.4)	6 (28.6)		
Tertiary	10 (90.9)	1 (9.1)		
Employment status			3.161	[a]0.104
Employed	13 (92.9)	1 (7.1)		
Unemployed	12 (66.7)	6 (33.3)		
Household income			0.110	[a]1.00
Below RM4851	16 (80.0)	4 (20.0)		
Above RM4851	9 (75.0)	3 (25.0)		
Anthropometry data				
Body mass index, kg/m²			8.312	[a]0.01*
Normal BMI	4 (44.4)	5 (55.6)		
Abnormal BMI	21 (91.3)	2 (8.7)		
Medical characteristics				
Clinical treatment				
Surgery			0.058	[a]1.00
Yes	13 (76.5)	4 (23.5)		
No	12 (80.0)	3 (20.0)		
Chemotherapy			0.058	[a]1.00
Yes	13 (76.5)	4 (23.5)		
No	12 (80.0)	3 (20.0)		
Radiotherapy			0.058	[a]1.00
Yes	13 (76.5)	4 (23.5)		
No	12 (80.0)	3 (20.0)		
Others			0.839	[a]0.426
Follow-up	13 (72.2)	5 (27.8)		
New case	12 (85.7)	2 (14.3)		
Cancer stage			0.019	[a]1.00
Stage I & stage II	10 (76.9)	3 (23.1)		
Stage III & stage IV	15 (78.9)	4 (21.1)		
Duration of diagnosis, years			0.058	[a]1.00
Below 2 years	12 (80.0)	3 (20.0)		
Above 2 years	13 (76.5)	4 (23.5)		
Handgrip strength				
Hand grip strength, dominant hand (kg/force)			0.962	[a]0.37
Low, <18 kg/force	19 (82.6)	4 (17.4)		
Normal, ≥18 kg/force	6 (66.7)	3 (33.3)		

*Significant at p < 0.05

[a]Fisher's exact test

Association of sociodemographic characteristics, anthropometry data, medical characteristics and handgrip strength with protein intake

Sociodemographic characteristics, anthropometry data, medical characteristics and handgrip strength did not reveal significant associations with protein intake.

Table 7

Association of Sociodemographic Characteristics, Anthropometry Data, Medical Characteristics And Handgrip Strength With Protein Intake (n = 32)

Variables	**Protein intake**		**X^2**	***p*-value**
	Adequate (Above 1 g/kg/day)	Inadequate (Below 1 g/kg/day)		
Sociodemographic characteristics				
Age,years			1.524	[a]0.252
25 - 60	15 (62.5)	9 (37.5)		
Above 60	3 (37.5)	5 (62.5)		
Ethnic			1.358	[a]0.355
Malay	14 (51.9)	13 (48.1)		
Non-malay	4 (80.0)	1 (20.0)		
Marital status			1.576	[a]0.365
Married	16 (61.5)	10 (38.5)		
Unmarried	2 (33.3)	4 (66.7)		
Educational level			4.453	[a]0.061
Primary & secondary	9 (42.9)	12 (57.1)		
Tertiary	9 (81.8)	2 (18.2)		
Employment status			2.330	0.127
Employed	10 (71.4)	4 (28.6)		
Unemployed	8 (44.4)	10 (55.6)		
Household income			0.847	0.358
Below RM4851	10 (50.0)	10 (50.0)		
Above RM4851	8 (66.7)	4 (33.3)		
Anthropometry data				
Body mass index, kg/m²			0.709	[a]0.453
Normal BMI	4 (44.4)	5 (55.6)		
Abnormal BMI	14 (60.9)	9 (39.1)		
Medical characteristics				
Clinical treatment				
Surgery			0.161	0.688
Yes	9 (52.9)	8 (47.1)		
No	9 (60.0)	6 (40.0)		
Chemotherapy			0.161	0.688
Yes	9 (52.9)	8 (47.1)		
No	9 (60.0)	6 (40.0)		
Radiotherapy			1.245	0.265
Yes	8 (47.1)	9 (52.9)		
No	10 (66.7)	5 (33.3)		
Others			0.653	0.419
Follow-up	9 (50.0)	9 (50.0)		
New case	9 (64.3)	5 (35.7)		
Cancer stage			0.907	0.341
Stage I & stage II	6 (46.2)	7 (53.8)		
Stage III & stage IV	12 (63.2)	7 (36.8)		

Duration of diagnosis, years			0.161	0.688
Below 2 years	9 (60.0)	6 (40.0)		
Above 2 years	9 (52.9)	8 (47.1)		
Handgrip strength				
Hand grip strength, dominant (kg/force)			2.672	[a]0.132
Low, <18 kg/force	15 (65.2)	8 (34.8)		
Normal, 18 kg/force	3 (33.3)	6 (66.7)		

*Significant at $p < 0.05$
[a]Fisher's exact test

Discussion

According to the most recent Malaysian National Cancer Registry report, female breast cancer patients are typically between the ages of 20 to 75+ years, with a peak occurrence observed at age 55 (Azizah et al., 2019). In terms of ethnicity, the report indicates that the highest incidence of breast cancer is among Chinese, followed by Indian and Malay individuals (Azizah et al., 2019). In contrast, this study reveals that Malays have the highest number of breast cancer cases. This discrepancy may be attributed to the study's purposive selection of only one institution and its small sample size, which could have resulted in a reduced response rate from individuals of other races. Besides, the majority of the respondents in this study were overweight and the observation was similar to previous studies, where the authors reported the highest prevalence of overweight and obese among breast cancer patients (Wong et al., 2022; Muthanna et al., 2022; Villar et al., 2017; Sahin et al., 2017). Weight gain had become major issue for most of the breast cancer women (Thomson et al., 2017; Makari-Judson et al., 2014) which may be due to oncological treatments (Sebri et al., 2022; Makari-Judson et al., 2014). Weight gain problems among breast cancer patients need to be handled seriously as being overweight can increase the chances of having diabetes, heart disease, hypertension and hypercholesterolemia that can impact overall survival or increase the chances of having breast cancer again (Rakhmanovna, P.O., 2022; Makari-Judson et al., 2014). Additionally, majority of respondents had low handgrip strength, which may be due to clinical symptoms and cancer-related nutritional damage that decline their physical activity level and further caused a reduction in handgrip strength (Hu et al., 2018). Moreover, previous study showed majority of breast cancer patients have inadequate energy and protein intake (Wong et al., 2022; Menon et al., 2014) which is contradict to the findings of this study. The differences may be due to underreporting (Wong et al., 2022), study population such as hospitalized cancer patients are more likely to experience malnutrition compared to outpatients (Silva et al., 2015), or the instrument used for dietary recall (Menon et al., 2014). This result proposed more serious protein inadequacy due to the higher proportion of protein inadequacy than energy inadequacy among breast cancer patients.

Association of Sociodemographic Characteristics With Energy and Protein Intake

A statistically significant association of age and energy intake was observed ($X^2 = 4.937$, $p = 0.047$). This indicates that inadequate energy intake as people age can be due to chronic diseases, medications, reduced mobility, social changes, and age-related physiological changes (Jamhuri et al., 2017; Menon et al., 2014). Another characteristics such as ethnicity, marital status, educational level, employment status, and household income do not exert a statistically significant influence on energy intake adequacy in this study. However, a recent study conducted by Muhamed et al. (2022) suggests that lower socioeconomic status may be associated with inadequate energy intake or malnutrition among breast cancer patients. The

nutritional status observed in the study showed a significant association with the economic conditions of the patients. Specifically, patients with the lowest economic status were found to be 94 times less likely to have adequate nutrition compared to patients with the highest economic status. Similarly, households with limited money or other resources have been associated with decreased nutrient intakes (Gundersen, C., & Ziliak, J. P., 2015). The lack of association between sociodemographic variables and protein intake adequacy may be explained by several factors. One possible explanation is that dietary habits and patterns of protein intake are driven by individual preferences, beliefs, and cultural norms that may not be closely tied to sociodemographic characteristics (Verwijs et al., 2022). Another possible explanation is that the study sample in this study, which may have included individuals with relatively similar sociodemographic backgrounds, limited the ability to detect significant associations. In support of this finding, a study conducted by Campos et al. (2018) where 772 cancer patients participated revealed that there is a positive association between higher socio-economic status and greater protein intake. Individuals from higher socio-economic classes tend to have higher purchasing power, which enables them to afford a wider range of food options.

Association of Anthropometry Data with Energy and Protein Intake

The Chi-square test revealed a statistically significant association between BMI and energy intake adequacy ($X^2 = 8.312$, $p < 0.01$). These findings suggest that there is a notable relationship between BMI and energy intake adequacy. Specifically, individuals with abnormal BMI values which is overweight or obese were more likely to have adequate energy intake compared to those with normal BMI values. A study by Alkan et al. (2018) found a significant association between BMI and malnutrition which is related to inadequate energy intake, supporting findings presented in this study where lower BMI is associated with lower energy intake. Higher BMI is associated with weight gain, which is common due to low physical activity, and increased energy intake during treatment (Saquib et al., 2007). However, there is no significant association between BMI and protein intake. The lack of significance suggests that BMI alone may not be a reliable predictor of protein intake adequacy in this population. Other factors such as dietary habits, overall nutritional status, and individual variations in protein requirements may also play a role in determining protein intake adequacy among breast cancer patients.

Association of Medical Characteristics with Energy and Protein Intake

There is no significant association of the medical characteristics examined, including clinical treatment variables, cancer stage, or duration of diagnosis, with energy intake in this study. However, De Vries et al. (2017) demonstrated a significant association between chemotherapy treatment and energy intake in their study population. This could be attributed to the occurrence of chemotherapy-related side effects. Side effects such as oral mucositis, intraoral mucositis, intraoral infection, dry mouth, salivary gland inflammation, mucosal bleeding, and intraoral hemorrhage can disrupt nutritional intake and impair the immune response. These side effects may lead to difficulties in consuming an adequate and balanced diet, resulting in an increased risk of malnutrition among the patients (Gebremedhin et al., 2021). Regarding cancer stage, recent study revealed an opposite finding from this study where the prevalence of malnutrition which indicates energy intake inadequacy was higher in the advanced stage of cancer (Gebremedhin et al., 2021). Similarly, the results indicate that none of the medical characteristics examined showed a significant association with protein

intake in this study. The findings of this study do not align with previous research by De Vries et al. (2017), where they found patients undergoing treatment had less protein intake than woman without cancer. Therefore, the lack of significant associations in this study may be attributed to various factors such as sample size, population characteristics, and differences in measurement methods.

Association of Handgrip Strength with Energy and Protein Intake

There is no significant association found between handgrip strength with energy intake. This may be attributed to several factors. Firstly, hand grip strength primarily reflects upper body muscle strength and may not directly correlate with energy intake, which is influenced by various factors such as demographics, body mass index, mental score and overall physical activity level (Lee et al., 2012). Secondly, the sample size in this study may be relatively small, limiting the statistical power to detect significant associations. The finding also suggests that hand grip strength does not play a significant role in determining protein intake adequacy among the respondents. In contrast to the findings, previous research has shown a significant association between hand grip strength and protein intake. For instance, a study conducted by Choi E.Y (2023) found that higher protein intake was associated with higher hand grip strength. The author suggested that increasing protein intake and engaging in strength exercises are effective strategies for preserving muscle strength in older individuals.

Limitations and Suggestions

Several limitations were identified in this study. The limited sample size may affect the generalizability of the findings, the time constraint might have restricted the researchers' ability to recruit a larger sample size, and the adoption of one institution may not fully represent the diversity and characteristics of the entire breast cancer population. Hence, it is recommended to expand the study to include multiple centers and a larger sample size. Besides, consider including additional factors that may be associated with energy and protein adequacy among breast cancer patients, such as nutrition counseling or nutritional knowledge to obtain a more comprehensive understanding of the determinants of energy and protein intake.

Conclusion

The findings of this study highlight the importance of addressing specific factors that may influence energy and protein intake. The significant associations between age and energy intake suggest the need to consider age-related factors when developing interventions to optimize energy intake among breast cancer patients. Furthermore, the association between BMI and energy intake emphasizes the importance of managing body weight and ensuring a well-balanced diet to meet the energy needs of patients. This finding highlights the potential impact of body weight on energy intake and reinforces the need for personalized dietary interventions.

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