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Assessment of Dietary Intake in Patients with Breast Cancer Receiving Chemotherapy

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Abstract: ***Chemotherapy is the most common treatment for the breast cancer in women. Appetite, diet and the nutritional nutrients may change when patients undergoing chemotherapy treatment. This Cross-sectional hospital based study was carried out to assess the dietary intake and the effects of chemotherapy dosage on the nutritional status of 276 females who were diagnosed with cancer and are undergoing chemotherapy in Radiation and Isotopes Center Khartoum (RICK). The participants in this study were selected randomly. Data was collected using questionnaire and 24 hour recall that were filled and administered by the researcher through interviews with breast cancer patients. The collected data was analyzed using computerized methods of analysis (SPSS) and (Nutri-survey 2007). The results indicated that, the majority of participants in the present study were lived in Khartoum state, their age varied between 30-50 years old. The 24 hours recall demonstrated that energy intake among the participants was lower than the Recommended Dietary Allowances (RDA).The intake of fat, cholesterol, and fiber among the participants was also lower than the recommended dietary allowances (RDA), while intake of carbohydrates and protein among them was more than the RDA. The intake of vitamins (A, E, C) was less than RDA. The intake of B vitamin among the participants, including B1, B2, B6 and folic acid was less than RDA. Minerals intake which included Sodium, potassium, calcium, magnesium and zinc, was less than the RDA, while the intake of phosphorus and iron was more than RDA. Significant correlations was found between energy intake (p=0.001), carbohydrate intake (p=0.024), B2 intake (p=0.007), (zinc intake (p=0.027) and magnesium intake (p=0.002) with chemotherapy dosage among the participants. The study recommended that, early nutrition interventions and education play an important role in improving the nutrition status and quality of life of breast cancer patients.***

Keywords: breast cancer, chemotherapy, 24 hours recall, food habits, RDA.

1. Background

Breast cancer is the most common type of cancer in women, both in the developed and the developing world .The incidence of breast cancer is increasing in the developing world due to increase urbanization and adoption of western lifestyles (Bloom, et al. 2011). It was estimated to account for 1,105,000 cases and 373,000 deaths in women in 2011(Abegunde & Stanciole, 2010). In Sub-Saharan Africa breast cancer accounted for 16.8 percent of all females cancers. Central, West, and East Africa appear to have lower incidence rates than southern Africa, the latter estimated at 33.4% per 100,000 (Jamison, et al. 2006).In Sudan, about 22.48% of women were diagnosis with the breast cancer, most of the cases diagnosed in advanced stages 80-85 % (Khartoum Oncology Specialized Center. 2012).

There are various risk factors for the breast cancer including aging (older than 55), family history of breast cancer, early menarche, late menopause, first term pregnancy after age 25 years, prolonged use of exogenous estrogen increases the risk of postmenopausal breast cancer (Anderoli, et al.2007).

Nutritional need changes for most persons during the phases of cancer treatment. In fact nutrition therapy can help cancer patients get the nutrients to maintain body weight and performance status, prevent body tissue from breaking down and rebuild tissues (Tian, et al. 2007).

The anti-cancer treatment (e.g. Chemotherapy) could influence nutritional status of the patients (UnSal, et al.2006).Chemotherapy is the most common treatment for the breast cancer in women. Chemotherapy includes a series of treatments every two to three weeks over a period of months, lasting as long as six months (Hampton, 2010). Appetite, diet and the nutritional nutrients may change when patients undergoing chemotherapy treatment (Hampton, 2010). Chemotherapy can also influence the taste and smell of food for a patient, which may lead to food aversion. In addition, the side effects of chemotherapy such as nausea, vomiting, early satiety, constipation, diarrhea xerostomia (dry mouth), and mucositis (inflammation of the mucous membrane) can reduce food intake as well (Bussink, 2012).

2. Justification

Patients with breast cancer need nutrition as it is an essential part of the recovery and healing process. Maintaining optimal nutrition during breast cancer treatment can help prevent malnutrition, support immune function, rebuild body tissue, decrease the risk of infection and enhance the overall well-being.
In Sudan no published data is currently available regarding the dietary intake of Sudanese women with breast cancer and the effects of chemotherapy on their nutritional status, thus this study has been designed to study the nutritional status of breast cancer patients receiving chemotherapy, and to evaluate the effects of this treatment on their dietary intake.

3. General Objectives

To assess the dietary intake of women with breast cancer receiving chemotherapy, as well as to evaluate the effects of

chemotherapy on their dietary energy intake, and other nutrients.

4. Materials and Methods

This Cross-sectional hospital-based study was carried out among females who were diagnosed with cancer and are undergoing chemotherapy in Radiation and Isotopes Center Khartoum (RICK). Data was collected using questionnaire and 24 hour recall that were filled and administered by the researcher through interviews with respondents.

A total of 276subjects were selected using a specific formula to determine an appropriate sample size.

Formula: Sample Size = n / [1 + (n/population)]
In which n = Z * Z [P (1-P)/(D*D)]
P = True proportion of factor in the population, or the expected frequency value
D = Maximum difference between the sample mean and the population mean,
Or Expected Frequency Value minus (-) Worst Acceptable Value
Z = Area under normal curve corresponding to the desired confidence level
Confidence Level/ Value for Z
90% / 1.645
95% / 1.960
99% / 2.575
99.9% / 3.29

Sample Selection:
Patients were selected randomly using systematic random technique:
Formula = total patients\ sample size
985\276 = 3.56

Then calculated three patients and selected number four from the sample according to the equation until the sample size (276) was completed

Criteria of Selection
All female patients diagnosed with breast cancer and underwent chemotherapy treatment in Radiation and Isotopes Center Khartoum (RICK).

Data Analysis

The data collected was analyzed using computerized methods of analysis (SPSS software program) and (Nutri-survey 2007)

5. Results

This chapter presents the results obtained from analysis of findings, of the dietary intake and the effect of chemotherapy on nutritional status of breast cancer patients attended Radiation and Isotopes Center Khartoum.

Table 1: Distribution of the participants by Age Group:

Age group (years)	Participants	
	Frequency	Percent (%)
<30	21	7.6
30-40	58	21.0
40-50	96	34.8
>50	101	36.6
Total	276	100.0

Table 1. Indicates that, the (36.6%) of the participants within the age group fifty and more years old followed by the age group of 40-50 (34.8%), (21%) of the participants below the age group of 30-40, while only (7.6%) were below 30 years old among participants.

Table 2: Distribution of participants according to the number of chemotherapy doses:

Number of chemotherapy doses	Frequency	Percent (%)
2 doses	51	18.5
3 doses	51	18.5
4 doses	49	17.8
5 doses	45	16.3
6 doses	63	22.8
7 doses	4	1.4
8 doses	7	2.5
10 doses	4	1.4
12 doses	1	.4
17 doses	1	.4
Total	276	100.0

Table.2. Shows, the majority (22.8%) of the participants had six chemotherapy doses, (18.5%) had second and third chemotherapy doses , (17.8%) had four doses chemotherapy, (16.3%) had five chemotherapy doses ,(2.5%) had eight chemotherapy doses , (1.4%) had seven and ten chemotherapy doses and only (0.4%) had twelve and seventeen chemotherapy doses .

Table 3: Distribution of participants according to the complications encountered after chemotherapy doses:

Complication	Frequency	Percent (%)
loss of appetite or Nausea	80	29
Vomiting	7	2.5
Taste changes	3	1.1
difficulty in chewing or swallowing	6	2.2
Diarrhea	5	1.8
Constipation	6	2.2
loss of appetite/nausea, taste changes, difficulty in chewing or swallowing	61	22.1
All	13	4.7
Nothing	8	2.9
loss of appetite or nausea + vomiting	49	17.8
vomiting +loss of appetite	11	4
Diarrhea +vomiting +loss of appetite	9	3.3
Diarrhea +taste changes + loss of appetite	9	3.3
increase in the blood glucose and fatigue	1	0.4
loss of appetite +vomiting taste changes	8	2.9
Total	276	100

Table .3. Reveals different complications among participants who received chemotherapy doses.

Table 4: Distribution of participants according to the duration of eating normal diet after chemotherapy doses:

Duration	Frequency	Percent (%)
1-3 hrs	79	28.6
4-6 hrs	19	6.9
7-9 hrs	16	5.8
after one day	30	10.9
after two days	13	4.7
after three days	41	14.9
after four days	9	3.3
after five days	14	5.1
after 10 days	21	7.6
after week	34	12.3
Total	276	100.0

Table .4. Shows, the majority (28.6 %) of the participants able to eat after undergoing chemotherapy treatment 1-3 hours , (14.9%) after three days, (12.3%) after week, (10.9 %) after one day, (7.6 %) after ten days , (6.9 %) after 4-6hours ,(5.8%) 7-9hours , (5.1%) after five days , (4.7%) after two days and only (3.3%) able to eat after four days.

24-Hour Recall:

Table 5: Distribution of participants according to Macronutrients & Micronutrients:

Macronutrients	Participants	
Energy	Frequency	Percent (%)
< 1900	220	61.6
1900 - 2000	29	15.2
2000 - 3000	8	4.3
≥ 3000	19	18.8
Total	276	100%
Carbohydrate/ g	Frequency	Percent (%)
< 130	34	12.3
130 -140	13	4.7
140 – 150	13	4.7
> 150	216	78.3
Total	276	100%
Fibers/ g	Frequency	Percent (%)
< 20	107	38.8
20 - < 30	90	32.6
30 - < 40	47	17.0
≥ 40	32	11.6
Total	276	100%
Proteins/ g	Frequency	Percent (%)
< 46	58	21.0
46-50	49	17.8
50-56	29	10.5
> 56	140	50.7
Total	276	100%
Fat/ g	Frequency	Percent (%)
< 20	157	56.9
20- 30	18	6.5
30 – 35	14	5.1
≥ 35	87	31.5
Total	276	100%
Cholesterol/ mg	Frequency	Percent (%)
< 200	212	76.8
200 - < 250	17	6.2
250 - < 300	9	3.3
≥ 300	38	13.8
Total	276	100%
Micronutrients	Participants	
Vitamin C/ mg	Frequency	Percent (%)
< 75	132	47.8
75- 80	12	4.3
80 – 85	14	5.1
> 85	118	42.8
Total	276	100%
Vitamin E/ mg	Frequency	Percent (%)
< 15	265	96.0
15-20	6	2.2
20-25	1	.4
> 25	3	1.1
22.00	1	.4
Total	276	100%
Vitamin A/ mg	Frequency	Percent (%)
< 700	173	62.7
700- 850	17	6.2
850 -900	18	6.5
> 900	68	24.6
Total	276	100%
Vitamin B1	Frequency	Percent (%)
<1.1	135	48.9
1.1- 1.5	119	43.1
1.5- 2	12	4.3
>2	10	3.6
Total	276	100%
Vitamin B2	Frequency	Percent (%)
< 1.1	73	26.4
1.1- 1.5	138	50.0
1.5- 2	59	21.4
>2	6	2.2
Total	276	100%
Vitamin B6	Frequency	Percent (%)
< 1.3	172	62.5
1.3 -1.5	62	22.5
1.5 – 2	26	9.5
> 2	15	5.5
Total	276	100%
Folic acid	Frequency	Percent (%)
< 400	271	98.2
400 – 450	2	.7
450- 500	1	.4
> 500	1	.4
Total	276	100%
Sodium/ mg	Frequency	Percent (%)
> 1200	101	36.6
1200- 1500	43	15.6
1500- 2000	60	21.7
> 2000	72	26.1
Total	276	100%
Potassium/ mg	Frequency	Percent (%)
< 4700	253	91.7
4700- 5000	8	2.9
5000- 5700	7	2.5
> 5700	8	2.9
Total	276	100%
Calcium/ mg	Frequency	Percent (%)
< 1,200	212	76.8
1200- 1,500	34	12.3
1,500- 2000	16	5.8
> 2000	14	5.1
Total	276	100%
Magnesium/ mg	Frequency	Percent (%)
< 320	222	80.4
320- 400	29	10.5
400- 420	11	4.0
>420	14	5.1
Total	276	100%

Zinc/ mg	Frequency	Percent (%)
< 8	136	49.3
8- 10	62	22.5
10 -18	68	24.6
> 18	10	3.6
Total	276	100%
Iron/mg	Frequency	Percent (%)
< 8	29	10.5
8- 10	25	9.1
10- 18	86	31.2
> 18	136	49.3
Total	276	100%

Phosphorus	Frequency	Percent (%)
< 700	53	19.2
700- 750	15	5.4
750- 800	19	6.9
> 800	189	68.5
Total	276	100%

Table .5. Shows, the macronutrients and micronutrients intake among the participants.

Table 6: Correlation between chemotherapy doses and Macro nutrients among the participants:

Variable	Energy intake		Carbohydrate Intake		Protein Intake		Fat Intake		Cholesterol Intake	
	R	**P**	**R**	**P**	**R**	**P**	**R**	**P**	**R**	**P**
Chemotherapy doses	-.208**	0.001	0.123*	0.024	0.029	0.634	0.046	0.550	-0. 017	0.781

**** Correlation is significant at 0.01 levels*/correlation is significant at 0.05 level**

Table .6. Demonstrates that, significant correlation was detected between energy (R= -0.208**, *p* = 0.001) and carbohydrate intake (R= 0.123*, *p*=0.024) with chemotherapy doses, and no correlation was detected between protein (R= 0.029, *p*=0.634) , fat (R=0.046 *p*=0.550,) and cholesterol intake (R= -0. 017, *p*= 0.781) with chemotherapy doses.

Table 7: Correlation between chemotherapy doses and Vitamins among the participants

Variable	Vitamin A		Vitamin E		Vitamin C		Vitamin B1		Vitamin B2		Vitamin B6		Vitamin folic acid (B9)	
	R	P	R	P	R	P	R	P	R	P	R	P	R	P
Chemotherapy doses	-0.069	0.252	0.060.-	0.319	0.001-	0.982	0.090	0.135	0.163**	0.007	0.072	0.232	0.008-	0.899

**** Correlation is significant at 0.01 levels*/correlation is significant at 0.05 level**

Table .7. Reveals that, significant correlation was found between vitamin B2 (R= 0.163**. P= 0.007) with chemotherapy doses and no correlation was detected between vitamin A(R= --0.069,P= 0.252) , vitamin E(R=-0.060,P=0.319) vitamin C(R= - 0.001,P= 0.982) vitamin B1(R= 0.090,P= 0.135) vitamin B6(R= 0.072,P=0.232) and Vitamin B9 (folic acid)(R= - 0.008,P= 0.899) with chemotherapy doses .

Table 8: Correlation between chemotherapy doses and Minerals among the participants:

Variable	Sodium		Potassium		Calcium		Magnesium		Zinc		Iron		Phosphorus	
	R	P	R	P	R	P	R	P	R	P	R	P	R	P
Chemotherapy dose	0.016	0.789	-0.044	0.468	0.025	0.684	0.190**	0.002	0.133*	0.0 27	0.029	0.632	0.004-	0.951

**** Correlation is significant at 0.01 levels*/correlation is significant at 0.05 level**

Table . 8. Reveals, significant correlation was detected between magnesium (R=0.190**, *p* = 0.002) and zinc (R= 0.133, *p*= 0.027) with chemotherapy doses and no correlation was detected between sodium (R=0.016, p= 0.789), potassium (R=-0.044, *p*=0.468), calcium (R= 0.025, p= 0.684), Iron (R= 0.029, *p*= 0.632) and phosphorus (R= -0.004, *p*= 0.951) with chemotherapy doses.

6. Discussion

This study was designed to assess the dietary intake of patients' women with breast cancer who attended Radiation and Isotopes Center in Khartoum state and the effect of chemotherapy treatment on their nutrition status.

In present study the majority of participants were lived in Khartoum state, their age varied between 30-50 years old.

The 24 -hours food recall results revealed that, energy intake among participants were lower than the recommended dietary allowances (RDA).The finding is not in line with previous study which found, significant increase in energy intake among breast cancer patients over the course of chemotherapy treatment (Harvie *et al.* 2005). These differences in energy may be due to differences in the socioeconomic status or lack of awareness about the type of diet provided to breast cancer patients having chemotherapy doses (Harvie, *et al.* 2005).The intake of fat and cholesterol were lower than the recommended dietary allowances (RDA), similar study in agreement with the present study which found that, fat intake was reduced among breast cancer patients undergoing chemotherapy (Brown, et al. 2001), while another study showed that women who received chemotherapy treatment had increased levels of cholesterol (Bing, et al.2004).

Significant correlation was detected between energy intake (P=0.001) with chemotherapy doses and no correlation was detected between fat intake (p=0.550), cholesterol (p= 0.781) with chemotherapy doses.

The intake of Carbohydrates and protein among the participants in the present study was more than RDA, while the intake of fiber was lower than the RDA, the findings was not in line with study demonstrated the decreased in carbohydrate intake with increased chemotherapy dosage (Klement, & Kämmerer, 2011). On the other hand, another study found that increased in protein intake associated with increased chemotherapy doses (Altgelt & Mccullochm, 2012). A significant correlation was found between carbohydrate intake (p=0.024) and chemotherapy doses. No significant correlation was detected between protein intake (p= 0.634) with chemotherapy doses.

The intake of vitamins (A, E, C) among participants was less than RDA. Previous study was not in line with the present study which showed an adequate intake of vitamin C, vitamin E, and vitamin A (Thoresen, et al.2005). Scientific evidence suggests that combining certain chemotherapy treatments with certain antioxidants at specific dosages can help improve drug effectiveness or reduce the severity of side effects (Altgelt & Mccullochm, 2012).

No correlation was detected between vitamin A intake (p=0.252), vitamin E (p= 0.319) and vitamin C (p=0.982) with chemotherapy doses.

The intake of vitamin B including (B1, B2, B6 and B9) among the participants in the present study was less than the RDA. This finding is not in agreement with previous study conducted by McNaughton, et al.(2005) who found higher dietary intake of vitamin B1 and B2 among patients with breast cancer; this may explain their survival during the chemotherapy cycle. Significant correlation was found between vitamin B2 (R= 0.163**. P= 0.007) with chemotherapy doses and no correlation was detected between the others B vitamins with chemotherapy doses.

The intake of minerals (Sodium, Calcium, Magnesium, Potassium and Zink) by the participants was less than RDA, while the phosphorus and iron intake was more than RDA. Previous study was similar to the present study, which revealed that, the chemotherapy treatment had reduced Sodium, Calcium, Magnesium and Potassium in premenopausal breast cancer patients (Elgaili, et al.2010). Significant correlation was detected between magnesium (p=0.002) and zinc intake (p=0.027) with chemotherapy doses and no correlation was detected between Sodium (P= 0.789), potassium (p= 0.468), calcium (p=0.684), phosphorus (p=0.951), and iron intake (p=0.632) with chemotherapy doses.

7. Conclusions

Significant correlations were found between energy, carbohydrate, zinc and magnesium intake with chemotherapy dosage.

8. Recommendation

Based on the findings of this study, the following recommendation should be considered:

All breast cancer patients receiving chemotherapy should have nutritional assessment from initiation of the treatment, should focus on current nutritional status and anticipate nutritional problems related to treatment. Nutrition education is needed among Sudanese women with breast cancer, who receive chemotherapy treatment on type of food they should consume in order to improve their nutritional status. Future studies are needed to evaluate the nutritional status of breast cancer patients receiving chemotherapy to prevent nutritional deficiency, and to improve quality of life.

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