THE EFFECT OF CHEMOTHERAPY ON NUTRITIONAL STATUS OF WOMEN WITH BREAST CANCER

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ABSTRACT

This study is a case control hospital base study conducted from July 2012 to April 2013 to assess the effect of chemotherapy doses on nutritional status of 276 female who diagnosed with breast cancer attending Radiation and Isotopes Center Khartoum (RICK) has been selected randomly to participate in this study. The main objective of the study was to assess the effect of chemotherapy on nutritional status of breast cancer patients. Data collected by using questionnaire and 24-hour food recall were filed through interviews with respondents. The collected data were analyzed using computerized methods of analysis (SPSS and Nutri-sarvey). The results revealed that, among case group the majority of women ages above 50 and more, and most of them lived in Khartoum state compared with control group, the majority of women is ages are between 30-40 and 40-50years old and most of them live in Khartoum state as the cases group, .BMI among control group compared with BMI of women received chemotherapy (case group), as follows: about 43.5% Vs 54.3%of women had normal body weight (BMI = 18.5-24.9 kg/m²). 27.9 %vs 23.2% were overweight (BMI= 25-29.9 kg/m²) and 14.9 % vs 6.9% were obese class I (30-34.9kg/m²) , 3.3 % vs 15.6% were under weight (BMI=<18.5 kg/m²), only 7.3% of control group were obese class II (35-39.9 kg/m²). 24 hours recall demonstrated that energy intake among respondents cases compared with respondents control were lower than the recommended daily allowances (RDA).The intake of fat and cholesterol were lower than the recommended daily allowances (RDA) among both (case and control group) while fiber intake among control group was more than recommended daily allowances compared with lower intake of respondent cases. The intake of Carbohydrates and protein among cases and control group in the present study were more than the RDA and at the same time the intake of fiber among cases was lower than the RDA compared with control group which was more than RDA. The intake of vitamins (A, E, C) zinc and folic acid among women both of case and control group in the present study was less than RDA.The intake of mineral (Sodium, calcium and magnesium) among both cases and control group was less than RDA. Also the intake of potassium was less than RDA among cases compared with control group which their intake was more than RDA, while the phosphorus intake and iron intake was more than RDA among both case and control group .The intake of B vitamins (B1, B2 and B6) among the respondents cases and control in the present study was less than the RDA. Hemoglobin level among 83% of respondents cases within the normal range (10.4-15.6g/dl)and 13.4% were anemic (<10. 4g/dl).Significant association was found between energy intake(P=0.001), carbohydrate intake(P=0.041) zinc intake(P=0.027)and magnesium intake (P=0.002) with chemotherapy dose among cases group, On the other hand, no significant correlation were detected between intake of fat (P=0.911), cholesterol (P= 0.781) , proteins intake (p= 0.336), sodium, intake (P= 0.789), potassium intake (P= 0.468), calcium intake (P=0.684), iron intake (P=0.632), and BMI (P=0.609) , Hemoglobin level (P= 0.437) with chemotherapy doses among the respondents cases. The study recommended that, all breast cancer patients receiving chemotherapy should have nutritional assessment from the beginning of the treatment. Nutrition education is needed among Sudanese populations regarding the breast cancer patients who are receiving chemotherapy.

Breast cancer is the top 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 life expectancy, increase urbanization and adoption of western lifestyles. It was estimated to account for 1,105,000 cases and 373,000 deaths in women in 2011. Incidence rates are about five times higher in Western countries than in less developed countries and Japan. Globally, Cancer represents a major global public health problem. Annually it accounts for 7.1 million deaths Worldwide, it has been predicted that, by 2020, 15 million new cancer cases will be added every year. Breast cancer is the most common cancer affecting women about 1.4 million new cases are diagnosed each year. In Sub-Saharan Africa breast cancer accounted for 16.8 percent of all female cancers. Central, West, and East Africa appear to have lower incidence rates than southern Africa, the latter estimated at 33.4 per 100,000. An estimated total of 48,600 cases occurred in Sub-Saharan Africa in 2002. In Sudan, about 22.48% of women were diagnosis with the breast cancer in 2011(Radiation and Isotopes Center Khartoum statistics registrations, 2012). Most of the cases diagnosed in advanced stages 80 -85% (Khartoum Oncology Specialized Center, 2012). Some tests are used to screen for different types of cancer and to find cancers early and the commonly tests are mammogram and clinical breast exam (CBE) . Risk factors for the breast cancer including older age (older than 55), family history of breast cancer ,early menarche, late menopause, first term pregnancy after age 25 years ,nulliparity, prolonged use of exogenous estrogen, and

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obesity and weight gain during adulthood increases the risk of postmenopausal breast cancer, during menopause, estrogen is primary produced in fat tissue, more fat tissue can increase estrogen levels, thereby increasing breast cancer. Exposure to ionizing radiation as is used in treatment of Hodgkin's disease, also increase the risk of the breast cancer .Only 5% to 10% of patients with the breast cancer are associated with the breast cancer susceptibility genes BRCA1 and BRCA2 (is a gene located on chromosome 17 which, if mutated, may predict high risk) (Anderoilet al,. 2007). Also a high fat diet (saturated fat) may contribute to breast cancer by raising estrogen level in the body (estrogen increases the number of the cells in the breast during menstruation it also may stimulate the growth of breast cancer cells. Breast cancer can be detected among young ladies by breast self examination (BSE), clinical breast examination (CBE), and mammography, breast self examination (BSE) has an important role when encouraged to do monthly breast cancer can be found at an earlier stage, which is associated with better overall survival (Dowm,2004). Breast cancer therapy can be divided into two basic types: local therapy (Surgery and radiation therapy) and systematic therapy (chemotherapy, hormonal, and immunotherapeutic agents) . Chemotherapy is the most common treatment for the breast cancer in women. Chemotherapy is a series of treatments every two to three weeks over a period of months, lasting as long as six months. Appetite and diet may change when undergoing treatment (Hampton, 2010).In addition, the anti-cancer treatment (e.g. Chemotherapy) could influence nutritional status. Chemotherapy can influence the taste and smell of food for a patient, which may lead to food aversion. Although, the side effect of chemotherapy such as nausea and vomiting, early satiety, constipation, diarrhea,xerostomia (dry mouth), and mucositis (inflammation of the mucousmembrane) can reduce food intake, as well (Bussink, 2012).

Justification

Patients with breast cancer need nutrition as important part of the 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. Some common ailments breast cancer patients experience include weight loss, weight gain, fatigue, nausea, diarrhea and constipation. Also, breast cancer and its treatment can bring about metabolic changes that cause or aggravate symptoms of diabetes (National Cancer Institute, 2009).

In Sudan no published data regarding the effects of chemotherapy on the nutritional status among Sudanese women with breast cancer , therefore, the present study is designed to study the nutritional status of breast cancer patients receiving chemotherapy, and to evaluate the effect of this treatment on weight, energy intake, and hemoglobin.

MATERIALS AND METHODS

This study is case-control hospital based study, carried out in Radiation and Isotopes Center Khartoum (RICK) in Khartoum State. Two groups of women the first one called control group included female who were not treated with chemotherapy and another group called case group include female patients with breast cancer exposed to the Radiation and Isotopes Center Khartoum (RICK) in Khartoum State during the period of the study. A total of 276subjects form each control and case group 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 calculate three patients and select number four from the sample according to the equation until complete the sample size (276).

Criteria of Selection

For case group: All female patients diagnosed with breast cancer and treated with chemotherapy who attended Radiation and Isotopes Center Khartoum (RICK). For control group: all female with another disease except female diagnosed with breast cancer and treated with chemotherapy.

RESULTS

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

Patient's Demographic-Socioeconomic Characteristics
Age Distribution of the Respondents

Table 1, shows that, the (36.6%) of the respondents with age group fifty and more years old followed by the age group of 40-50 (34.8%), (21%) of the respondents below the age group of 30-40, while only (7.6%) were below 30 years old among case group compared with (31.2%) of the respondents among control group with age group between 30- 40 and 40-50 followed by (18.9%) of respondents were

Table 1: Distribution of the Respondents by Age Group

Age group (Years)	Control group		Case group	
	Frequency	Percent (%)	Frequency	Percent (%)
<30	52	18.8	21	7.6
30-40	86	31.2	58	21.0
40-50	86	31.2	96	34.8
>50	50	18.9	101	36.6
Total	276	100.0	276	100.0

Table 2: Distribution of the Respondents according to place of Origin in Sudan

Stats	Control group		Case group	
	Frequency	Percent (%)	Frequency	Percent (%)
Red Sea State	18	6.5	7	2.5
River NileState	14	5.1	27	9.8
North State	14	5.1	49	17.8
KassalState	13	4.7	30	10.9
Khartoum State	130	47.1	80	29.0
Gezira State	22	8.0	27	9.8
Gedaref State	11	4.0	14	5.1
Sennar State	12	4.3	8	2.9
Blue Nile State	12	4.3	7	2.5
White Nile State	12	4.3	8	2.9
Kordofan states	8	2.9	6	2.2
Darfur states	10	3.6	13	4.7
Total	276	100.0	276	100.0

age group fifty and more years old ,while only (18.8%) of respondents below the age group of 30.

Table 2 show that distribution of the respondents according to place of origin in Sudan.

Distribution of the Respondents according to Education levels

Table 3, shows that, (40.9%) of the respondents (case group) were illiterate, (24.6%) had primary education, (22.5%) had secondary education, (10.1%) had university education, (1.1%) had Postgraduate studies and only(0.7%) had Khalwa education regarding control group ,(27.2%) of them had primary school, (22.8%) had secondary school , (17.8%) had Khalwa education ,(15.6%) had university education, (8.7%) had postgraduate and only (8%) were illiterate.

Table 3: Distribution of the Respondents according to Education levels

Education Level	Control group		Case group	
	Frequency	Percent (%)	Frequency	Percent (%)
Illiterate	22	8.0	133	40.9
Khalwa	49	17.8	2	.7
Primary school	75	27.2	68	24.6
Secondary school	63	22.8	62	22.5
University	43	15.6	28	10.1
Postgraduate	24	8.7	3	1.1
Total	**276**	**100.0**	**276**	**100.0**

Table 4: Distribution of respondents Occupation

Occupation	Control group		Case group	
	Frequency	Percent (%)	Frequency	Percent (%)
Business	15	5.4	15	5.4
Professional	49	17.8	-	-
Laborer	108	39.1	11	4.0
house wife	58	21.0	215	77.9
Government employee	42	15.2	17	6.2
Unemployed	4	1.5	18	6.5
Total	**276**	**100.0**	**276**	**100.0**

Table 4 show distribution of respondents occupation.

Distribution of Respondents according to Body Mass Indexes (BMI)

Table 5, shows, among case group (54.3%) of respondents had normal weight, (23.2%) were overweight, (15.6%) were under weight and (6.9%) were obese class I .As for the control group,(43.5%) were enjoyed normal healthy weight , (27.9%) were over Wight , (14.9%) were obese class I, (7.2%) were obese class II and (3.3 %)were under weight and morbid obese.

Correlation between chemotherapy dose and body Mass Index (BMI), weight loss and weight gain

Table 6 shows no correlation was detected between BMI (R=-0.031, P=0.609) with chemotherapy doses and type of chemotherapy with BMI (R= 0.060, P=0.317).

Mean and Standard Deviation of anthropometric, Hemoglobin level and energy intake

Table 7 shows, Mean and standard deviation were calculated for age, energy, hemoglobin level.

Table 6: Correlation between chemotherapy dose and body Mass Index (BMI)

Variable	BMI	
	R	P
Chemotherapy doses	-0.031	0.609
Type of Chemotherapy doses	0.060	0.317

Table 7 : Mean and Standard Deviation of anthropometric, Hemoglobin level and energy intake

Variables	Mean/SD
BMI after receiving chemotherapy	2.2138±0.78714
Age	3.0036±0.94001
Energy	1.3696 ±0.84057
Hemoglobin	1.9022 ±0.40163

Table 5 : Distribution of Respondents according to Body Mass Indexes (BMI)

Severity	BMI /kg/m²	Body Mass index (BMI)			
		Control group		Case group	
		Frequency	Percent (%)	Frequency	Percent (%)
Under weight	<18.5	9	3.3	43	15.6
Normal weight	18.5-24.9	120	43.5	150	54.3
Over weight	25-29.9	77	27.9	64	23.2
Obese class I	30-34.9	41	14.9	19	6.9
Obese class II	35-39.9	20	7.2	-	-
Morbid obesity	≥40	9	3.3	-	-
Total		**276**	**100.0**	**276**	**100.0**

Table 8 : Distribution of Respondents among case group 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	0.4
17 doses	1	0.4
Total	276	100.0

Distribution of Respondents among case group according to the Number of Chemotherapy Doses

Table 8 shows the majority (22.8%) of the respondents' had six chemotherapy dose , (18.5%) had second and third chemotherapy dose , (17.8%) had four dose chemotherapy, (16.3%) had five chemotherapy dose ,(2.5%) had eight chemotherapy dose , (1.4%) had seven and ten chemotherapy dose and only (0.4%) had twelve and seventeen chemotherapy dose.

Table 9 shows that the majority (88.4%) of the respondents did not have other disease associated with cancer, (6.5%) had diabetes, (3.6%) had hypertension,(0.7%) had psychological problems and only (0.4%) had

Table 9 : Distribution of Respondents according to other Diseases

Type of diseases	Control group		Case group	
	Frequency	Percent (%)	Frequency	Percent (%)
Hypertension	9	3.3	10	3.6
gastro intestinal tract (GIT) disease	11	4	1	.4
Diabetes	27	9.8	18	6.5
Non	205	47.3	244	88.4
Cramp	-	-	1	0.4
Psychological problems	-	-	2	0.7
Liver diseases	16	5.8	-	-
Renal diseases	2	0.7	-	-
Heart diseases	6	2.2	-	-
Total	276	100.0	276	100.0

Table 10 : Distribution of Respondents among case group according to the complication encountered after chemotherapy doses

Complication	Frequency	Percent (%)
loss of appetite or Nausea	80	29.0
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	4.0
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	.4
loss of appetite +vomiting taste changes	8	2.9
Total	276	100.0

gastro intestinal tract (GIT) disease and cramp As for the control group (47.3%) did not have diseases, (9.8%) had diabetes, (5.8%) had liver disease, (4%) had GIT diseases, (3.3%) had Hypertension, (2.2%) had heart diseases and only (0.7%) had renal diseases .

Table 10 reveals different complication among breast cancer women who received chemotherapy dose.

Distribution of Respondents among case group according to Duration of eating food after chemotherapy doses normal diet

Table 11 shows, the majority (28.6 %) of the respondents able to eat after taken chemotherapy dose 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-

Table 11: Distribution of Respondents among case group according to Duration of eating food after chemotherapy doses normal diet

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 12 : Distribution of respondents among case group according to the type of food directly taken after chemotherapy doses

Type of food	Frequency	Percent (%)
Fluids	92	33.3
semi-fluids	50	18.1
soft- diet	34	12.3
Normal diet	71	25.7
acid food	23	8.3
food without sugar	6	2.2
Total	276	100.0

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.

Table, 12 distribution of respondents among case group according to the type of food directly taken after chemotherapy doses:

Distribution of respondents among case group according to the type of food directly taken after chemotherapy doses

Table12 shows that,(33.3%) of respondents were taking fluids directly after the chemotherapy dose ,(25.7%) had normal diet , (18.1 %) had semi fluids , (12.3%) had soft diet , (8.3%) had acid food and only (2.2%) were taking food without sugar.

Distribution of Respondents who were found to have taken vitamins tablets or supplementation

Table, 13 showed that, (88%) of respondent's cases did not take vitamins as supplement, and only (12%) of them took vitamins. (92.4%) of the control group took

vitamins and only (7.6%) didn't take any vitamins.

Distributions of Respondents according to the type of vitamins

Table, 14 The following medications are taken by the respondent's cases: (30.3%) Omega H3, (21.2%)fefol , (9.1%) vitamin B complex (6.1%) vitamin imunos , vitamin B complex and Ferrous gluconate (fefol), spork and jansonbeckett , multi- vitamins, omega 3 and Ferrous gluconate (fefol), only (3%) vitamin B complex , DAS and gesunde plus , feroglobin , GR6,Omega 3 ,B complex. Regarding control group (47.6%) took vitamin B complex, (38.1%) vitamin B complex and only (14.3%) of them took omega 3.

Respondents among case group who Received Nutritional Advice after Starting chemotherapy

Table 15 shows, (94.6%) of the respondents did not take any nutritional advice on chemotherapy, only (5.4%) did.

Distribution of respondents according to level of hemoglobin level, RBCs, TWBCs and Platelets

Table 16 shows that the level of hemoglobin,

Table13: Distribution of Respondents who were found to have taken any vitamins tablets or supplementation

Taken vitamins or supplementation	Control group		Case group	
	Frequency	Percent (%)	Frequency	Percent (%)
Yes	21	7.6	33	12.0
No	255	92.4	243	88.0
Total	276	100.0	276	100.0

Table 14: Distributions of respondents according to the type of vitamins

Types of vitamins	Control group		Case group	
	Frequency	Percent (%)	Frequency	Percent (%)
Spark and Janson-beckett			2	6.1
Omega H3			10	30.3
Vitamin B+DAS gesunde plus			1	3.0
Vitamin Imunos			2	6.1
Vitamin B+Ferrousgluconate (fefol)			3	9.1
Ferrous gluconate(Fefol)			7	21.2
Feroglobin			1	3.0
Multi vitamins	10	47.6	2	6.1
Omega 3 + Ferrous gluconate(Fefol)			2	6.1
GR6Capsules			1	3.0
Omega 3	3	14.3	1	3.0
B complex	8	38.1	1	3.0
Total of case group	33		100.0	
Total of control group	21		100.0	

Table 15: Respondents among case group who Received Nutritional Advice after Starting chemotherapy

Taken Nutritional Advice After Starting chemotherapy	Frequency	Percent (%)
Yes	15	5.4
No	261	94.6
Total	276	100.0

RBCs, TWBCs and Platelets among cases.

Distribution of Respondents according to Macronutrients& Micronutrients

Table 17 shows, the macronutrients and micronutrients intake among the respondents (case and control group)

Biochemical measurements of respondents among case group

Table 16 : Distribution of respondents according to level of hemoglobin level, RBCs, TWBCs and Platelets

hemoglobin (g/dl) level	Frequency	Percent (%)
<10.4	37	13.4
10.4-15.6	229	83.0
>15.6	10	3.6
Total	**276**	**100.0**
10^3/ ml TWBCs	Frequency	Valid Percent
< 3.0	31	11.2
3.0-9.0	224	81.2
>9.0	21	7.6
Total	**276**	**100.0**
Million/mlRBCs	Frequency	Percent
<3.2	39	14.1
3.2-5.0	221	80.1
>5.0	16	5.8
Total	**276**	**100.0**
(%)Platelets	Frequency	Percent
<140	13	4.7
140-450	231	83.7
>450	32	11.6
Total	**276**	**100.0**

Table 17 : Distribution of Respondents according to Macronutrients & Micronutrients

Macronutrients	Control group		Case group	
Energy	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
< 1900	170	79.7	220	61.6
1900 - 2000	42	10.5	29	15.2
2000 - 3000	12	2.9	8	4.3
= 3000	52	6.9	19	18.8
Total	**276**	**100%**	**276**	**100%**
Carbohydrat e/ g	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
< 130	31	11.2	34	12.3
130 -140	50	18.1	13	4.7
140 – 150	46	16.7	13	4.7
> 150	149	54.0	216	78.3
Total	**276**	**100%**	**276**	**100%**
Fibers/ g	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
< 20	68	24.6	107	38.8
20 - < 30	81	29.3	90	32.6
30 - < 40	58	21.0	47	17.0
= 40	69	25.0	32	11.6
Total	**276**	**100%**	**276**	**100%**
Proteins/ g	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
< 46	48	17.4	58	21.0
46-50	38	13.8	49	17.8
50-56	26	9.4	29	10.5
> 56	164	59.4	140	50.7
Total	**276**	**100%**	**276**	**100%**
Fat/ g	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
< 20	141	51.1	157	56.9
20- 30	14	5.1	18	6.5
30 - 35	15	5.4	14	5.1
= 35	106	38.4	87	31.5
Total	**276**	**100%**	**276**	**100%**
Cholesterol/ mg	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
< 200	184	66.7	212	76.8
200 - < 250	21	7.6	17	6.2
250 - < 300	11	4.0	9	3.3
= 300	60	21.7	38	13.8
Total	**276**	**100%**	**276**	**100%**
Micronutrients	**Control group**		**Case group**	
Vitamin C/ mg	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
< 75	123	44.6	132	47.8
75- 80	3	1.1	12	4.3
80 – 85	11	4.0	14	5.1
> 85	139	50.4	118	42.8
Total	**276**	**100%**	**276**	**100%**

Vitamin E/ mg	Frequency	Percent (%)	Frequency	Percent (%)
< 15	240	87.0	265	96.0
15-20	17	6.2	6	2.2
20-25	12	4.3	1	.4
> 25	7	2.5	3	1.1
22.00	240	87.0	1	.4
Total	**276**	**100%**	**276**	**100%**
Vitamin A/ mg	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
< 700	144	52.2	173	62.7
700- 850	12	4.3	17	6.2
850 -900	3	1.1	18	6.5
> 900	117	42.4	68	24.6
Total	**276**	**100%**	**276**	**100%**
Vitamin B1	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
<1.1	95	34.4	135	48.9
1.1- 1.5	140	50.7	119	43.1
1.5- 2	34	12.3	12	4.3
>2	7	2.5	10	3.6
Total	**276**	**100%**	**276**	**100%**
Vitamin B2	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
< 1.1	29	10.5	73	26.4
1.1- 1.5	109	39.5	138	50.0
1.5- 2	105	38.0	59	21.4
>2	33	12.0	6	2.2
Total	**276**	**100%**	**276**	**100%**
Vitami n B6	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
< 1.3	155	56.2	172	62.5
1.3 -1.5	59	21.4	62	22.5
1.5 – 2	34	12.3	26	9.5
> 2	28	10.1	15	5.5
Total	**276**	**100%**	**276**	**100%**
Folic acid	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
< 400	266	96.4	271	98.2
400 – 450	3	1.1	2	.7
450- 500	3	1.1	1	.4
> 500	4	1.5	1	.4
Total	**276**	**100%**	**276**	**100%**
Sodium/ mg	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
> 1200	61	22.1	101	36.6
1200- 1500	32	11.6	43	15.6
1500- 2000	64	23.2	60	21.7
> 2000	119	43.1	72	26.1
Total	**276**	**100%**	**276**	**100%**
Potassium/ mg	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
< 4700	61	22.1	253	91.7
4700- 5000	35	12.7	8	2.9
5000- 5700	54	19.6	7	2.5
> 5700	126	45.7	8	2.9
Total	**276**	**100%**	**276**	**100%**

Calcium/ mg	Frequency	Percent (%)	Frequency	Percen t (%)
< 1,200	151	54.7	212	76.8
1200 - 1,500	36	13.0	34	12.3
1,500 - 2000	37	13.4	16	5.8
> 2000	52	18.8	14	5.1
Total	276	100%	276	100%
Magnesium/ mg	Frequency	Percent (%)	Frequency	Percent (%)
< 320	206	74.6	222	80.4
320 - 400	30	10.9	29	10.5
400 - 420	22	8.0	11	4.0
>420	18	6.5	14	5.1
Total	276	100%	276	100%
Zinc/ mg	Frequency	Percent (%)	Frequency	Percent (%)
< 8	115	41.7	136	49.3
8 - 10	43	15.6	62	22.5
10 - 18	89	32.2	68	24.6
> 18	29	10.5	10	3.6
Total	276	100%	276	100%
Iron/mg	Frequency	Percent (%)	Frequency	Percent (%)
< 8	12	4.3	29	10.5
8 - 10	17	6.2	25	9.1
10 - 18	63	22.8	86	31.2
> 18	184	66.7	136	49.3
Total	276	100%	276	100%
Phosphorus	Frequency	Percent (%)	Frequency	Percent (%)
< 700	27	9.8	53	19.2
700 - 750	10	3.6	15	5.4
750 - 800	10	3.6	19	6.9
> 800	229	83.0	189	68.5
Total	276	100%	276	100%

Table 18, show that Distribution of Respondents according to Macronutrients & Micronutrients

Table 18 : Correlation between chemotherapy doses and Macro nutrientsamong case group

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	0.036	0.550	- 0.017	0.781

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

Correlation between chemotherapy doses and Macro nutrients among case group

Table 18 demonstrates that, significant correlation was detected between energy intake (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 intake (R= 0.634, P=0.029), fat intake (R= 0.550, P= 0.036) and cholesterol intake(R=0.781, P= - 0.017) with chemotherapy doses.

Correlation between chemotherapy doses and Vitamins among case group

Table 19 reveled that, significant correlation was found between vitamin B2 (R= 0.163**. P= 0.007) with chemotherapy dose and on 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

10

Table 19 : Correlation between chemotherapy doses and Vitamins among case group

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
Chemoth erapy Dose	-0.069	0.252	0.06-0.	0.319	0.0-01	0.982	0.090	0.135	0.163**	0.007	0.072	0.232	0.0-08	0.899

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

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 .

Correlation between chemotherapy doses and Minerals among case group

Table 20 reveled that, significant correlation was detected between magnesium (R=0.190**, P = 0.002) 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), zinc (R= 0.133*, P= 0.029) iron (R= 0.029, P= 0.632), phosphorus (R= - 0.004, P= 0.951) with chemotherapy doses.

DISCUSSION

This study was designed to identify the effect of chemotherapy on nutritional status of breast cancer patients Attended Radiation and Isotopes Center Khartoum.

In the present study, among case group the majority of women ages above 50 and more, and most of them lived in Khartoum state. Similar age (50 years old) reported in central Sudan in women who diagnosed with breast cancer (Elgaili et al., 2010).Compared with control group, the majority of women their ages group between 30-40 and 40-50years old and most of them lived in Khartoum state as the cases group.

The majority of women among case group were illiterate compared with control group the majority of women were completed primary school education in the present study. Previous study was in agreement with the present study which showed there was A positive relationship between level of education and female breast cancer risk (Braaten et al., 2004).Married women appeared to have a higher ratio than single, divorced and widowed women among both of case group and control group in the present study. The finding was not in line with previous study which found that, Married women appear to have a higher rate of survival than single, divorced, separated or widowed women(Declerck et al., 2002) .some studies have shown either no relationship between marital status and breast cancer survival rates, or even a negative correlation between being married and longer survival rates (De Boer et al.,1999).

In the present study 29.3% of women among cases their income below 100 pounds compared with 39.5 of woman among control group was between 100-399 pounds.Previous study was in agreement with the present study which showedlower socioeconomic status has been reported to be associated with decreased breast cancer incidence and mortality and increased case-fatality .

Also in the present study the majority of women (both of case and control group) having children. Previous study showednever pregnant women compared with an increasing number of full-term pregnancies was associated with reduction of the breast cancer (Huiyan et al., 2010).

BMI among control group compared with BMI of women received chemotherapy (case group), as follows: about 43.5% Vs 54.3%of women had normal body weight (BMI = 18.5-24.9 kg/m²). 27.9 %vs 23.2% were overweight

Table 20 : Correlation Between Chemotherapy Doses And Minerals Among Case Group

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*	0.027	0.029	0.632	- 0.004	0.951

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

(BMI = 25-29.9 kg/m²) and 14.9 % vs 6.9% were obese class I (30-34.9kg/m²) , 3.3 % vs 15.6 were under weight (BMI=<18.5 kg/m²), only 7.3% of women were obese class II (35-39.9 Kg/m²) among control group .This changes on the BMI among cases is positively associated with increase intake of chemotherapy, the present studies were in agreement with previous studies that found variation on BMI after receiving chemotherapy dose (Litton et al, 2007), (Alharbi, 2008). Also this variation in weight was proved by previous studies stated, increased and decreased weight by doses of chemotherapy (Griggs et al., 2005).No correlation was detected between chemotherapy dose intake (P=0.609), the type of chemotherapy dose (P=0.317) with BMI.

In the present study 33.3% of women drank fluids directly after taking chemotherapy dose (after 1-3 hours) .The decreased in oral intake due to taste alteration lead to involuntary weight loss and ultimately malnutrition.

The 24 hours food recall results revealed that, energy intake of women among respondents cases compared with respondents control were lower than the recommended daily allowances (RDA).The finding is not in line with previous study which found that, significant increase in energy intake among breast cancer patients over a course of chemotherapy. 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 daily allowances (RDA) among both (case and control group) while fiber intake of women among control group was more than recommended daily allowances compared with lower intake respondent cases .Previous study in line with the present study found that, fat intake was reduced among breast cancer patients having chemotherapy doses. Also another study was not in line with the present study which showed that women who received chemotherapy treatment had increased levels of cholesterol.

Significant correlation was detected between energy intake (P=0.001) with chemotherapy dose and no correlation was detected between fat intake (P=0.911), cholesterol (P= 0.781) with chemotherapy dose.

The intake of Carbohydrates and protein among cases and control group in the present study were more than RDA and at the same time the intake of fiber among cases was lower than the RDA compared with control group which was more than RDA. Previous study was not in line with the present study which revealed that, decreased in carbohydrate intake with increased chemotherapy doses (Klement and Kammerer, 2011). On the other hand, previous study found that increased in protein intake associated with increased chemotherapy dose (Ovesenet al. 1993).Significant correlation was found between carbohydrate intake (P=0.041) and chemotherapy dose. No significant correlation was detected between protein intake (p= 0.336) with chemotherapy dose.

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 et al., 2012).

The intake of vitamins (A, E, C) zinc and folic acid among women both of case and control group in the present study was less than RDA. Previous study was in agreement with the present study which showed an adequate intake of vitamin C, vitamin E and zinc and inadequate intake of vitamin A and selenium .

Significant correlation was detected between zinc intake (P=0.027) with chemotherapy dose and no correlation was detected between vitamin A intake (P=0.252), vitamin E (P= 0.319), vitamin C (P=0.982), folic acid (P=0.899) with chemotherapy dose.

The intake of mineral (Sodium, calcium and magnesium) among both cases and control group was less than RDA. Also the intake of potassium was less than RDA among cases compared with control group which their intake was more than RDA, while the phosphorus intake and iron intake was more than RDAamong both case and control group . Previous study was in line with the present study, revealed that the chemotherapy treatment had reduced bone mineral density (BMD) in premenopausal breast cancer patients. Significant correlation was detected between magnesium intake (P=0.002) with chemotherapy dose and no correlation was detected between Sodium intake (P= 0.789), phosphorus intake (P=0.951), calcium (P=0.684), iron (P=0.632), potassium (P= 0.468), with chemotherapy dose.

The intake of B vitamins (B1, B2 and B6) among

therespondent's cases and control in the present study was less than the RDA. Higher dietary intake of vitamin B1 and B3 was associated with improved survival during the chemotherapy cycle. No significant correlation was detected between B1 vitamin (P=0.135), B2 vitamin (P=0.007), B6 vitamin (P=0.232) with chemotherapy dose.

88% of respondent's cases in the present study did not take vitamins as supplementation compared with 92.4% of the control group. Previous study was not in line with the present study which revealed that Vitamin supplement use in the first 6 months after diagnosis of breast cancer may be associated with reduced risk of mortality and recurrence. another previous study showed the use of vitamins C, E, folic acid, and calcium decreased during treatment while vitamin B6 increased.

83.0 % of the respondents cases had normal range of hemoglobin (10.4-15.6g/dl), 13.4% were anemic (<10.4g/dl,) and no significant relationship was detected between hemoglobin level among the respondent cases (P =0.437) and chemotherapy doses.

This may indicated that women hemoglobin did not affect by the chemotherapy doses the finding in the present study was not in line with previous study revealed that the hemoglobin was decreased among women who received chemotherapy doses (Kailajärvi et al., 2000).

CONCLUSION

Significant correlations were found between energy intake, carbohydrate intake zinc intake and magnesium intake with chemotherapy dose.On the other hand, no significant correlation were detected between fat intake , cholesterol intake , proteins intake, sodium intake , potassium intake , calcium intake, iron intake , and Body Mass Index BMI with chemotherapy doses

Recommendation

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

All breast cancer patients receiving chemotherapy should have nutritional assessment with the start of the treatment, and should focus on current nutritional status and anticipated nutritional problems related to treatment Nutrition education is needed among Sudanese populations with breast cancer who receive chemotherapy treatment on type of food should be eaten to improve their nutritional status. Future researches are needed to evaluate the nutritional status of breast cancer patients receiving chemotherapy to prevent nutritional deficiency, and to improve quality of life

REFERENCES

Alharbi A.M., 2008. The Effect of Chemotherapy on Nutritional Status of Breast Cancer Patients: 9-12.

Altgelt J. and Mcculloch M., 2012. Breast Cancer, Chemotherapy, & Antioxidants . Http://www.pinestreetfoundation.org/avenues/avenues1920/byoa1920.html. Accessed 1, March, 2013.

Anderoli T.E., Carpenter C.C., Gridds R.C., Benjamin I.J., 2007. Cecil Essential of Medicine. 7th edition .India, **56**:582-583.

Braaten T., Weiderpass E., Kumle M., Adami H.O., Lund E., 2004. Education and risk of breast cancer in the Norwegian-Swedish women's lifestyle and health cohort study.Int J Cancer, **110**(4):579-83.

Bussink M., 2012. the role of nutrition on effectiveness of chemotherapy: 1-30.

Cancer Research UK., 2012. Breast cancer incidence statistics.

De Boer M. F., Ryckman R. M., Pruyn J. F. A, & Van den Borne H. W., 1999. Psychosocial correlates of cancer relapse and survival: a literature review. Patient Education and Counseling, **37**: 215-23.

Declerck C. H., De Brabander B., Boone C., & Gerits P., 2002.Locus of control, marital status and predictors of early relapse in primary breast cancer patients. Psychology and Health, **17**: 63-76.

Down K.H., 2004. Contemporary Issues in Breast Cancer: A Nursing Perspective.UK,2nd edition: 85-62.

Elgaili M.E., Abuidris D.O., Rahman M.R., Michalek,A.M and Mohammed S., 2010. Breast cancer burden in central Sudan.Int J Womens Health, **2**:77-82.

Griggs J.J., Melony E. S., Sorbero M.E.S., Lyman G.H., 2005. Under treatment of Obese Women Receiving Breast Cancer Chemotherapy. Arch Intern Med., **165**(11).

Hampton J., 2010 Diet for Chemotherapy in Breast Cancer http://www.livestrong.comarticle/ 344029-diet-for-chemotherapy-in-breast-cancer/Accessed 28, December, 2011.

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

Huiyan M., Enderson K.D., Sullivan-Halley J., Duan L., Sarah F Marshall S.F., Ursin G., Horn-Ross P.L., Largent J., Deapen D.M., James V Lacey J.V. and Jamison D.T., Feachem R.G., Makgoba M.W., et al., 2006 Disease and Mortality in Sub-Saharan Africa. 2nd edition. Washington (DC): World Bank, Chapter 20.

Kailajärvi M., Ahokoski O., Virtanen A., Salminen E. and Irjala K., 2000 Alterations in laboratory test results during adjuvant breast cancer treatment. ClinChem Lab Med., **38**(5):443-51.

Khartoum Oncology Specialized Center (KOSC), 2012 registrations of breast cancer diagnosed in 2011. Department of Cancer statistics registrations. Sudan.

Klement R.J. and Kämmerer U., 2011 Is there a role for carbohydrate restriction in the treatment and prevention of cancer? Nutrition & Metabolism journal, 8:75.

Litton J.K., Gonzalez A. M., Warneke C.L., Kau S., Buzdar A.U., Bondy M., Mahabir S., Hortobagyi G.N., Brewster A., 2007 Body mass index and response to neoadjuvant chemotherapy in breast cancer patients. Journal of Clinical Oncology, Part I. Vol **25**, No. 18S : 531