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Evaluation of Diets Served to Cancer Patients in Oncology Ward of University of Nigeria Teaching Hospital, Ituku/Ozalla, Enugu State

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Abstract: Nutrient adequacy of selected High Calorie High Protein diet served to cancer patients in Oncology ward of University of Nigeria Teaching Hospital (UNTH) Ituku/Ozalla Enugu was evaluated. The objectives were to find out what constitutes a high protein/calorie diets in the therapeutic diet kitchen, to determine the proximate and selected micronutrient composition of high protein/high calorie diet served to the cancer patients and to ascertain the adequacy of those diets using the nutrient density relative to standard values. Recipes of the foods consumed by cancer patients were collated from the menu of therapeutic diet kitchen in UNTH. A total of 14 most frequently consumed foods were sampled using frequency distribution table (the foods sampled include: beans and yam pottage, vegetable yam pottage, boiled yam, garri, okpa, moimoi, pap, fish, stew, rice, bitterleaf soup, okro soup and egusi soup and meat). The samples were analyzed in the laboratory to determine the proximate and micronutrient compositions. The results were subjected to statistical analysis to determine the mean and standard deviations and also, the nutrient densities were determined and compared with standards. The proximate composition showed that the diets served contain average of 79.95±17.95 g of protein, 51.39±19.58 g of fat, 635.29±128.32 g of carbohydrates daily making up an energy value of 3323.42±329.38 kcal daily. The result also showed that the daily percentage contribution of macronutrients to energy composition of the diets were 9.62% for protein, 13.93% for fats and 76.46% for carbohydrates respectively. The mean values of the micronutrients per serving portion were 43.09±8.26 for vitamin A, 19.28±1.78 for vitamin C, 24.25±6.92 for vitamin E, 22.26±2.71 for folate, 62.02±5.59 for zinc and 3.82±0.98 for selenium respectively. Among the foods, moi-moi, okpa, fish, stew, pap, OKS, ES, BLS and meat had high protein density of 313.48, 375, 851.28, 142.2, 78.72, 128.24, 125.60, 92.76, 136.28 and 617.92%, respectively. BYP and BY had moderate nutrient density of 67.04% and 65.84% respectively. VYP and GA had low nutrient density of 45.12 and 22.92%, respectively. All the foods had low vitamin A, selenium and folate densities relative to FAO/WHO reference value. The dishes served show that most of the foods were adequate (highly densed) and have potential for control and prevention of all types of cancers if dietary habits are maintained with improvements in vitamin A, selenium and folate content of the dishes as consumed.

Key words: Diets, adequacy, cancer, nutrient density

INTRODUCTION

Cancer is a term that encompasses over one hundred different types of diseases of which each has its own unique features and all types share some common features. Nutrition can be a factor in prevention and compromised nutrition can be considered a complication of the disease or the treatment process. Some cancers, especially lung, head and neck cancers, affect an individual's nutritional status even before the cancer is diagnosed. In addition, treatment of cancer, including surgery, chemotherapy and radiation, can have a substantial impact on an individual's nutritional status. Weight loss, anorexia, alterations in metabolism and lean body mass wasting that often occur in cancer patients can pose a significant impact on morbidity, mortality, the ability to endure or tolerate treatment and quality of life (Cohen, 2011).

According to National Cancer Institute (2013) cancer affects any part of the body and emanates from a single cell that changes into tumor cells through interaction

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between genetics and external agents. However, it is important to note that not all tumors are cancerous, benign tumors do not invade neighbouring tissues and do not spread throughout the body therefore they are not regarded as cancer. There are more than 200 different types of cancer that affects human. Cancer which can be called malignant tumor is a general term that refers to rapid formation of abnormal cells that grow beyond their boundaries (National Cancer Institute, 2013).

Anand *et al*. (2008) outlines the risk factors of cancer to include tobacco use, dietary factors, certain infections, exposure to radiation, sedentary behaviour, obesity and environmental pollutant. These factors has the potential to directly damage genes or combine with existing genetic faults within the cell to cause cancerous mutations (Kinzler *et al*., 2002). According to American Cancer Society (2013) approximately 5-10% of cancer can be traced directly to inherited genetic defects. Cancer risk reduction can be achieved by not smoking, eating more vegetables, fruits and whole grains, eating less meat and refined carbohydrates, maintaining healthy body weight, exercising, minimizing sunlight exposure and being vaccinated against some infectious diseases (Kushi *et al*., 2012).

Research on the role of nutrition in the cancer process has been extensively conducted by different groups and individual researchers. Evidence based studies have shown that nutrition plays a major role in cancer process (National Cancer Institute, 2013). Environmental factors such as diet and physical inactivity as well as obesity has been attributed to cause approximately 30-35% of cancer deaths (Kushi *et al*., 2012). This means that 30-35% of all cancers can be prevented by appropriate diet, physical activity and maintenance of appropriate body weight. Low fibre diet (low in vegetables, fruits and whole grains) high in processed red meat are related to a number of cancers (Kushi *et al*., 2012). Park *et al*. (2008) stated that diet high in salt is linked to gastric cancer, aflatoxin B1 to liver cancer and Betel nut chewing with oral cancer. Brenner *et al*. (2009) observed that gastric cancer is more common in Japan due to its high-salt diet.

Therapeutic nutrition is used to help cancer patients get the required nutrients to keep up their body weight, strength, keep body tissue healthy and to strengthen the immune system. Patients who are well nourished with enough proteins and calories thus have a better prognosis and quality of life (Cohen, 2011).

Dietary preventive measures against cancer have been typically, inclusion of vegetables, fruits, whole grains and fish and an avoidance or reduction of processed foods and red meat (beef, pork, lamb), animal fats and refined carbohydrates (Wicki and Hagman, 2011). Protective nutrients in a cancer prevention diet are majorly the antioxidant which include: selenium, carotenoids (alpha-carotene, lycopene, lutein, cryptoxanthin), vitamin E and vitamin C (intravenously). Also, vitamin D, vitamin B_{12}, chlorophyll and folic acid are known to be of benefit. (World Cancer Research Fund/American Institute for Cancer Research, 1997).

Cancer patients on treatment may experience nausea, vomiting, early satiety, dysgeusia, diarrhoea, mucositis, xerostomia, constipation, weight loss and anaemia. All of these side effects have the potential to place the individual at nutritional risk and, if not successfully treated, may result in malnutrition. The primary goal of nutrition therapy for the cancer patient is to prevent malnutrition, because reversing it may prove to be very difficult. The metabolic alterations can result to severe anorexia and cachexia that may not be amenable to common nutrition interventions (Cohen, 2011).

In the University of Nigeria Teaching Hospital (UNTH) Ituku/Ozalla, Enugu, the report of cancer cases is on the increase. Patients are referred from all parts of Nigeria to UNTH. Among these patients on therapeutic diets, majority of them are placed on high protein, high calorie diet. Determination of the adequacy of protein and calories in the diets served lead to this research.

The aim of this study was to analyze the adequacy of high protein, high calorie diet given to cancer patients in Oncology ward of University of Nigeria Teaching Hospital, Ituku/Ozalla, Enugu State. The specific objectives of the study were to:

1: To find out what constitute or make up high protein diets in the Therapeutic diet Kitchen of UNTH
2: To determine the proximate composition of high protein/high calorie diet given to cancer patients in Oncology ward of University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu State
3: To determine the energy and protein composition of the portion sizes served to the patients
4: To determine the micronutrients composition of the diet
5: To ascertain the adequacy of those diets in relation to cancer

The analysis of the high protein and high calorie diets served to the patients in Oncology ward will provide information on the nutrient composition of the diets served and to really compare with international recommendations based on calculations. This will help to ascertain patients are meeting up with their caloric and protein requirement. The outcome of this study will form a baseline for further research.

MATERIALS AND METHODS

Study design: The study was a laboratory analysis of food samples.

Sample collection and preparation: A total of 14 most frequently consumed foods were sampled using

frequency distribution table (the food samples include Beans and yam pottage, vegetable yam pottage, boiled yam, garri, okpa, moimoi, pap, fish, stew, rice, bitterleaf soup, okro soup, egusi soup and meat). The samples were collected from the therapeutic kitchen of Nutrition and Dietetics Department of University of Nigeria Teaching Hospital, Ituku/Ozalla, Enugu. After meal preparation, the portion sizes of the various foods as served to the cancer patients in oncology ward were collected for one week each day. Four days menu were used out of seven days because there was repetition of food preparation in the therapeutic kitchen. After food collection for each day, the food samples were stored in the freezer at <-18°C before laboratory analysis. The food samples collected for each day were coded, homogenized and analyzed on wet basis (that is, as consumed by the patients).

Proximate analysis: Moisture was determined with the standard method of the Association of Official Analytical Chemists (AOAC) (1995) no 925.10 using hot air oven. AOAC (1995) method was used to determine the ash composition.

Lipid was determined with the method described by AOAC (1995) no 963.15. Crude protein was determined with the micro Kjedahl method described by AOAC (1995) was used in the determination of the crude protein, which involves three stages-digestion, distillation and titration. The AOAC (1995) method, 962.09 was used to determine the crude fibre composition. Carbohydrate was determined by estimation using the arithmetic difference method described by Pearson (1976).

Vitamin analysis: Determination of vitamin A (retinol equivalent) was done using the method as described by Pearson (1976). Ascorbic acid (Vitamin C) determination was done by titration method of Osborn and Voogt (1978). Vitamin E determination was done using Pearson (1976) method. Folate (vitamin B_9) was determined with the method described by Association of Vitamin Chemists (1966).

Mineral determination: The method of Vogel (1965) was used to determine the selenium composition of the diets. The zinc content of the diets was determined by Alpha 4 automatic absorption spectrophotometer (AAS) (Onwuka, 2005).

Nutrient density: Nutritional adequacy of the diets was estimated using the food based dietary guideline (FAO/WHO, 1996). This is calculated as follow:

$$\left(\begin{array}{c}\text{Nutrient density (\%)}\\ \text{for each nutrient}\end{array}\right) = \left(\frac{\text{Analyzed value}}{\text{FAO/WHO reference value}}\right) \times 100$$

Nutrient density of foods as consumed was categorized on a scale of three, ≥70% for high nutrient density, 50-69% for moderate and ≤50% for low nutrient density.

Statistical analysis of the data: Means and standard deviations were calculated for the data generated from results of the laboratory analysis. Nutrient density was estimated as percentages of each ingredient in the recipe of dishes as consumed in relation to FAO/WHO (1996) values. The results (macro and micro nutrients levels) were used to compare with the nutrient requirements of cancer patients.

RESULTS

Nutrient composition of cooked foods consumed by cancer patients in UNTH Ituku/Ozalla, Enugu: Table 1 shows the proximate composition of selected cooked foods consumed by cancer patients in Oncology ward in UNTH Ituku/Ozalla, Enugu (per 100 g). The moisture content of these foods ranged from 27.78-86.41%. The moisture content of pap was highest with 86.41% and garri had the least moisture 27.78%. The protein composition ranged from 1.55 g in vegetable yam pottage (VYP) to 29.80 g in meat. The fat values of these foods ranged from 0.19/100 g in boiled yam (BY) to 13.03/100 g in Egusi soup (ES). Carbohydrate in the foods ranged from 2.31g/100 g in stew to 66.80g/100g in garri (GA). The fibre composition ranged from 0.17g/100g in ES to 3.25g/100g in okpa. However, fish, rice, pap and meat had no fibre in them. The ash content ranged from 0.31g/100g in pap to 6.50g/100g in moi-moi. The energy value (Kcal) gotten from the foods ranged from 49.6 Kcal/100 g in pap to 279 Kcal/100 g in garri.

Table 2 shows the proximate composition of selected cooked foods consumed by cancer patients in Oncology ward in UNTH Ituku/Ozalla, Enugu per portion size as served from the therapeutic diet kitchen. The moisture content of these foods per serving portion ranged from 30.16g/portion size in meat to 414.06g/portion size in Beans and Yam pottage (BYP). The protein composition ranged from 4.61g in bitter leaf soup (BLS) to 57.86g/portion size in okpa. The fat composition of these foods were 0.80g/portion size in rice to 32.58g/portion size in egusi soup. The carbohydrate content ranged from 4.62g/portion size in stew to 334g/portion size in garri. Fish and meat had no carbohydrate present in them. The fibre values ranged from 0.43g/portion size in BLS to 11.38g/portion size in okpa. The ash contents ranges from 1.09g/portion size in okro soup to 17.58g/portion size in moi-moi. Energy ranged from 57.80 kcal/portion size in fish to 756.09 kcal/portion size in vegetable yam pottage.

Table 3 showed the average daily macronutrients composition of diets served to cancer patients in

Table 1: Proximate composition of selected cooked foods/100 g as consumed by cancer patients in UNTH Ituku/Ozalla, Enugu

Food	Moisture (%)	Energy (Kcal)	Protein (g)	Fat (g)	Carbohydrate (g)	Fibre (g)	Ash (g)
BYP	69.01±0.003	122.3	2.05±0.003	2.02±0.01	23.98±0.003	1.33±0.01	1.61±0.01
VYP	65.93±0.001	137.47	1.55±0.01	1.31±0.01	29.87±0.01	0.28±0.01	1.06±0.01
BY	68.22±0.00	120.87	1.99±0.003	0.19±0.003	27.80±0.003	1.30±0.003	0.50±0.003
Moi-moi	75.35±0.01	96.97	7.60±0.003	5.05±0.003	5.28±0.003	0.22±0.01	6.50±0.003
Okpa	56.17±0.01	176.32	16.53±0.01	5.80±0.003	14.50±0.01	3.25±0.01	3.75±0.01
GA	27.78±0.003	279	1.60±0.03	0.60±0.00	66.80±0.003	1.40±0.003	1.82±0.003
Fish	71.19±0.003	115.59	24.60±0.003	1.91±0.001	0.00±0.01	0.00±0.00	2.30±0.00
Stew	82.00±0.001	113.07	4.02±0.01	9.75±0.01	2.31±0.01	1.16±0.00	0.76±0.01
Rice	66.31±0.003	134.12	2.64±0.003	0.20±0.01	30.44±0.01	0.00±0.00	0.41±0.01
Pap	86.41±0.003	49.6	1.59±0.003	0.40±0.00	10.00±0.00	0.00±0.00	1.60±0.00
OKS	85.91±0.01	62.10	1.95±0.01	1.98±0.01	9.12±0.003	0.73±0.01	0.31±0.003
ES	74.76±0.01	159.11	3.69±0.01	13.03±0.01	6.77±0.01	0.17±0.01	1.58±0.01
BLS	85.87±0.01	60.17	2.05±0.01	1.93±0.01	8.65±0.01	1.02±0.01	0.48±0.01
Meat	60.31±0.003	192.91	29.80±0.003	8.19±0.003	0.00±0.00	0.00±0.00	1.70±0.003

Mean value±standard deviation, BYP: Beans and Yam pottage, VYP: Vegetable Yam pottage, GA: Garri, OKS: Okro Soup, ES: Egusi soup, BLS: Bitter leaf soup, BY: Boiled yam

Table 2: Proximate composition of selected cooked foods consumed by Cancer patients in Oncology ward of UNTH Ituku/Ozalla, Enugu per portion size as served to the patients

Foods	Portion size (g)	Moisture (%)	Energy (Kcal)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)
BYP	600	414.06	733.80	12.30	12.12	143.88	7.98	9.66
VYP	550	362.62	756.09	8.53	7.21	164.29	1.54	5.83
BY	550	375.21	664.79	10.95	1.05	152.90	7.15	2.75
Moi-moi	275	207.21	266.67	20.90	13.89	14.52	0.61	17.88
Okpa	350	196.56	617.12	57.86	20.30	50.75	11.38	13.13
GA	500	138.90	139.50	8.00	3.00	334.00	7.00	9.10
Fish	50	35.60	57.80	12.30	0.96	-	-	1.15
Stew	200	164.00	226.14	8.04	19.50	4.62	2.32	1.52
Rice	400	265.24	536.48	10.56	0.80	121.76	-	1.64
Pap	300	259.23	148.80	4.77	1.20	30.00	-	4.80
OKS	350	300.69	217.35	6.83	6.93	31.92	2.56	1.09
ES	250	186.90	397.76	9.23	32.58	16.93	0.43	3.95
BLS	225	193.21	135.38	4.61	4.34	19.46	2.30	1.08
Meat	50	30.16	96.46	14.90	4.10	-	-	0.85

Mean value±standard deviation, CHO: Carbohydrate, BYP: Beans and Yam pottage, VYP: Vegetable Yam pottage, BY: Boiled Yam GA: Garri, OKS: Okro soup, ES: Egusi soup, BLS: Bitter leaf soup

Table 3: Average daily macronutrient composition of diets served to cancer patients in oncology ward of UNTH Ituku/Ozalla, Enugu

Parameter	Protein	Fat	CHO	Energy (Kcal)
Energy nutrient composition (g)	79.95±17.95	51.39±19.58	635.29±128.32	3323.42±329.38
Energy contribution (Kcal)	319.80	462.47	2541.15	3323.42
Energy contribution (%)	9.62	13.92	76.46	100.00

Mean value ± standard deviation

oncology ward of UNTH Ituku/Ozalla, Enugu. The proximate composition showed that diets served contained average of 79.95±17.95 g of protein, 51.39±19.58 g of fat, 635.29±128.32 g of carbohydrates daily making up an energy value of 3323.42±329.38 kcal daily. The results also showed that the daily percentage contribution of macronutrients to energy composition of the diets were 9.62% for protein, 13.93% for fats and 76.46% for carbohydrates, respectively.

Table 4 shows the vitamins and mineral composition of selected cooked foods served to Cancer patients in Oncology ward of UNTH Ituku/Ozalla Enugu per 100 g. The vitamin A composition of the foods ranged from 0.03 in meat to 8.50 µg, in fish Vitamin C content ranged from 0.12 mg in ES to 3.83 mg in stew. The vitamin E values ranged from 0.30 mg in pap to 4.17 mg in stew. The folate composition ranged from 0.14 mg in rice to 4.3 mg in meat. The zinc content ranged from 0.53 mg in BY to 5.40 mg in ES. The selenium composition ranged from 0.02 µg in rice to 0.47 µg in VYP.

Table 5 shows the vitamins and mineral composition of selected cooked foods per portion size served to Cancer patients in Oncology ward of UNTH Ituku/Ozalla Enugu.

Table 6 shows the mean values of the micronutrients per serving portion served to cancer patients in Oncology ward of UNTH Ituku/Ozalla Enugu. The values 43.09±8.26 for vitamin A, 19.28±1.78 for vitamin C, 24.25±6.92 for vitamin E, 22.26±2.71 for folate, 62.02±5.59 for zinc and 3.82±0.98 for selenium.

Table 7 shows the nutrient density of the selected foods per 1000Kcal served to Cancer Patients in Oncology ward of UNTH Ituku/Ozalla Enugu.

Table 4: Vitamins and Mineral composition of selected cooked foods per 100 g served to Cancer Patients in Oncology ward of UNTH Ituku/Ozalla Enugu

Food	Vitamin A (µg)	Vitamin C (mg)	Vitamin E (mg)	Folate (µg)	Zinc (mg)	Selenium (µg)
BYP	1.45±0.01	0.46±0.01	0.72±0.01	0.55±0.03	3.70±0.03	0.19±0.01
VYP	2.48±0.03	0.81±0.01	1.59±0.01	0.77±0.02	2.91±0.01	0.47±0.01
BY	2.81±0.01	1.01±0.03	0.62±0.01	1.43±0.01	0.53±0.01	0.19±0.02
Moimoi	1.00±0.03	1.31±0.02	1.64±0.02	1.52±0.00	3.80±0.03	0.62±0.01
Okpa	1.54±0.02	2.23±0.02	1.20±0.00	1.84±0.00	2.09±0.01	0.24±0.03
Garri	0.95±0.00	0.98±0.01	0.16±0.01	0.81±0.01	2.93±0.01	0.06±0.04
Fish	8.50±0.01	0.00±0.00	0.11±0.03	0.27±0.03	0.70±0.03	0.14±0.01
Stew	4.51±0.01	3.83±0.01	4.17±0.01	3.45±0.02	3.41±0.04	0.14±0.03
Rice	1.43±0.02	0.00±0.00	1.31±0.03	0.14±0.01	0.98±0.02	0.02±0.01
Pap	1.04±0.01	1.39±0.04	0.30±0.03	1.27±0.02	3.71±0.03	0.03±0.03
OKS	4.31±0.01	0.22±0.01	3.12±0.02	0.69±0.01	3.90±0.01	0.14±0.01
ES	2.15±0.03	0.12±0.01	1.09±0.02	0.69±0.01	5.40±0.03	0.15±0.01
BLS	4.91±0.03	0.27±0.03	2.31±0.03	0.83±0.03	4.20±0.14	0.18±0.03
Meat	0.03±0.01	0.00±0.00	0.97±0.01	4.30±0.01	0.81±0.01	0.16±0.01

Mean value±standard deviation, CHO: Carbohydrate, BYP: Beans and Yam pottage, VYP: Vegetable Yam pottage, BY: Boiled Yam GA: Garri, OKS: Okro soup, ES: Egusi soup, BLS: Bitter leaf soup

Table 5: Vitamins and Mineral composition of selected cooked foods served to cancer patients in Oncology ward of UNTH Ituku/Ozalla Enugu per portion size

Food	Portion size	Vitamin A (µg)	Vitamin C (mg)	Vitamin E (mg)	Folate (µg)	Zinc (mg)	Selenium (µg)
BYP	600	8.7	2.76	4.32	3.3	22.2	1.14
VYP	550	13.64	4.455	8.745	4.235	16.005	2.585
BY	550	15.455	5.555	3.41	7.865	2.915	1.045
Moi-moi	275	2.75	3.6025	4.51	4.18	10.45	1.705
Okpa	350	5.39	7.805	4.2	6.44	7.315	0.84
Garri	500	4.75	4.9	0.8	4.05	14.65	0.3
Fish	50	4.25	0	0.055	0.135	0.35	0.07
Stew	200	9.02	7.66	8.34	6.9	6.82	0.28
Rice	400	5.72	0	5.24	0.56	3.92	0.08
Pap	300	3.12	4.17	0.9	3.81	11.13	0.09
OKS	350	15.085	0.77	10.92	2.415	13.65	0.49
ES	250	5.375	0.3	2.725	1.725	13.5	0.375
BLS	225	11.0475	0.6075	5.1975	1.8675	9.45	0.405
Meat	50	0	0	0.485	2.15	0.405	0.08

CHO: Carbohydrate, BYP: Beans and Yam pottage, VYP: Vegetable Yam pottage, BY: Boiled Yam, GA: Garri, OKS: Okro soup, ES: Egusi soup, BLS: Bitter leaf soup

Table 6: Mean values of the micronutrients per serving portion served to cancer patients in Oncology ward of UNTH Ituku/Ozalla Enugu

Parameter	Vitamin A (µg)	Vitamin C (mg)	Vitamin E (mg)	Folate (µg)	Zinc (mg)	Selenium (µg)
Mean	43.09	19.28	24.25	22.26	62.02	3.82
Standard deviations	8.26	1.78	6.92	2.71	5.59	0.98

Among the foods, moi-moi, okpa, fish, stew, pap, OKS, ES, BLS and meat had high protein density of 313.48, 375, 851.28, 142.2, 78.72, 128.24, 125.60, 92.76, 136.28 and 617.92%, respectively. BYP and BY had moderate nutrient density of 67.04 and 65.84%, respectively. VYP and GA had low nutrient density of 45.12 and 22.92%, respectively. All the foods had low vitamin A, selenium and folate densities relative to FAO/WHO reference value.

DISCUSSION

Nutrient composition: The moisture content of these foods except garri was high. This is because the food samples were analyzed on wet basis. The higher the moisture content of foods, the lower its nutrient composition (Udofia and Obizoba, 2005). The low moisture of garri could be attributed to the amount of water used during preparation and the amount of water absorbed by the garri. The protein content of meat and fish were higher followed by okpa and moi-moi which are legume based. The high protein content of fish and meat is because they are of animal origin and their bioavailability will be higher. The protein content of moi-moi could be attributed to the other ingredient such as crayfish. The protein content of other foods was low because they are of plant origin. The protein content of legume-based foods had comparable values with the study of Okeke and Ene-Obong (1995). The high fat value of egusi soup was expected because of its high fat content (13.03 mg/100 g) and the additional palm oil

Table 7: Nutrient density of the selected foods per 1000 Kcal served to cancer patients in Oncology ward of UNTH Ituku/Ozalla, Enugu

FAO/WHO Ref. values	Protein 25 (g)	Fat 33.33 (g)	CHO 150 (g)	Fibre 14 (g)	Zinc 27.5 (mg)	Selenium >10 (µg)	Vitamin A (Retinol) 425 (µg) (RE)	Vitamin E 4.25 (mg)	Vitamin C 27.5 (mg)	Folate 175 (µg)
Dishes										
BYP: AV (PRV)	16.76 (67.04)	16.52 (49.56)	196.08 (130.72)	10.87 (77.64)	30.25 (302.50)	1.55 (15.54)	11.85 (2.79)	5.89 (138.58)	3.76 (13.68)	450 (2.57)
VYP: AV (PRV)	11.28 (45.12)	9.53 (28.59)	217.28 (144.85)	2.04 (14.57)	21.68 (211.68)	3.42 (34.19)	99.22 (23.35)	11.57 (272.14)	5.89 (21.43)	5.60 (3.20)
BY: AV (PRV)	16.46 (65.84)	1.57 (4.71)	229.99 (153.33)	10.76 (76.86)	4.38 (43.85)	1.57 (15.72)	23.25 (5.47)	5.13 (120.69)	8.36 (30.39)	11.80 (6.76)
Moimoi: AV (PRV)	78.37 (313.48)	52.08 (156.26)	54.45 (36.3)	2.27 (16.21)	39.19 (391.87)	6.39 (63.94)	10.31 (2.43)	16.91 (394.93)	13.51 (49.12)	15.67 (8.96)
OKPA: AV (PRV)	93.75 (375)	32.89 (98.68)	82.24 (54.83)	18.43 (131.64)	11.85 (118.53)	1.36 (13.61)	8.73 (2.06)	6.81 (160.14)	12.65 (45.99)	10.44 (5.96)
GA: AV (PRV)	5.73 (22.92)	2.15 (6.45)	239.43 (159.62)	5.02 (35.86)	10.50 (105.02)	0.22 (2.15)	3.41 (0.80)	0.57 (13.41)	3.51 (12.77)	2.90 (1.66)
FISH: AV (PRV)	212.82 (851.28)	16.52 (49.56)	0.00 (0.00)	0.00 (0.00)	6.06 (60.56)	1.21 (12.11)	73.54 (17.30)	0.95 (21.15)	(-)	2.34 (1.33)
STEW: AV (PRV)	35.55 (142.2)	86.23 (258.72)	20.43 (13.62)	10.26 (73.29)	30.17 (301.66)	0.15 (1.49)	39.88 (9.39)	36.87 (867.50)	33.87 (123.17)	30.51 (17.43)
PAP: AV (PRV)	32.06 (128.24)	8.06 (24.18)	201.61 (134.41)	0.00 (0.00)	74.80 (747.98)	0.60 (6.00)	20.98 (4.94)	6.04 (142.31)	27.82 (101.17)	1.04 (0.59)
OKS: AV (PRV)	31.40 (125.6)	31.88 (95.65)	146.86 (148.14)	11.76 (84.00)	62.80 (628.02)	2.25 (22.54)	66.51 (15.65)	17.55 (412.99)	3.54 (12.88)	11.11 (6.35)
ES: AV (PRV)	23.19 (92.76)	81.89 (245.69)	42.55 (28.37)	1.07 (7.64)	33.94 (339.39)	0.94 (9.43)	13.51 (3.18)	6.85 (161.19)	15.76 (57.36)	4.34 (2.48)
BLS: AV (PRV)	34.07 (136.28)	32.08 (96.25)	143.76 (95.84)	16.95 (121.07)	69.80 (698.02)	2.99 (29.92)	81.60 (19.20)	13.79 (824.57)	81.60 (296.74)	13.79 (7.88)
MEAT: AV (PRV)	154.48 (617.92)	42.46 (127.39)	0.00 (0.00)	0.00 (0.00)	19.23 (192.32)	0.83 (8.29)	0.16 (0.04)	5.03 (118.35)	5.08 (18.47)	22.29 (12.74)

AV: Actual values, PRV: Percentage of FAO/WHO/UNU 1996 Reference values, VYP: Vegetable yam pottage, ES: Egusi soup, BYP: Beans and yam pottage, BY: Boiled yam, BLS: Bitterleaf soup, OKS: Okro soup, GA: Garri

used during preparation. The high fat content of meat could be attributed to the part of meat used and meat products generally are good source of fat. The fat content of stew, moi-moi and okpa could be attributed to the quantity of oil used for their preparations. Garri (tuber based made from cassava) had the highest carbohydrate content followed by rice which is cereal based. This is in line with Ihekeronye and Ngoddy (1985) who documented 90.18% carbohydrate for rice. The high fibre content of okpa (Bambara nut) could be attributed to the method of processing the seeds.

The different ash contents of these foods could be due to the level of micronutrients present in each food and the ingredients used in its preparations. Okpa particularly has appreciable amounts of vitamins and minerals (5.39 mg of vitamin A, 7.81 mg vitamin C, 7.81 mg vitamin E, 6.44 mg folate, 7.32 mg zinc) in 350 g cooked portion. The highest vitamin A content of fish was expected because sea foods have been noted to be high in vitamin A (USDA National Nutrient database for standard reference, Release 25). The anti-oxidative effect of vitamin A could help reduce oxidative effect of cancer stress. The high vitamin A contents of OKS, BLS, VYP, stew and ES could be attributed to their vegetable contents. Vegetable and fruit consumption confers protective effect against various cancers (Cohen *et al.*, 2000; Oniang *et al.*, 2003). This could be attributed to its vitamin A and other anti-oxidant properties. This made these foods appropriate in serving them to cancer patients in the Oncology ward of UNTH. The high vitamin C content of stew is expected because it is the only food that contains tomatoes and fresh pepper. Oniang *et al.* (2003) stated that fresh pepper and tomatoes are rich sources of vitamin C. However foods in general have moderate vitamin C contents. This is because cooking reduces the vitamin C content of foods. The high vitamin E content of stew (4.17 mg), OKS (3.12 mg) and BLS (2.31 mg) could be attributed to the vegetables used in their preparation. The appreciable folate content of meat was expected because meat and meat products are sources of folate. The high folate level of stew could be attributed to the tomatoes used in the preparation of the stew. The folate content in other foods could be associated with their green leafy vegetable and beans. All the foods were low in selenium content.

Nutrient density: The high protein density of these foods was expected because of their protein contents. BYP and BY had moderate protein density while VYP had low protein density. This is because yam is not a good source of protein. More water is needed in the cooking of VYP than BY hence, the protein composition will reduce in higher moisture (Udofia and Obizoba, 2005). The high fat density of stew, moi-moi, okpa, meat and BLS could be attributed to the quantity of oil used during preparation while that of ES, meat and OKS could be as

a result of fat component of other ingredients such as dikanut (ogbono) and egusi used respectively as well as oil used during preparation. Meat is a good source of fat. Low fat density of other foods observed in this research are in line with FAO/WHO (1996) report that total dietary fat provides an average 18% of total food energy in sub-Sahara with some countries obtaining as little as 7-15% of food energy from fat.

The high carbohydrate density of most of these foods are expected because studies have shown that the bulk of a typical Nigerian diet is from staples (cereals, grains, root (tuber) (Hill, 1990; Oniang *et al*., 2003; Maziya-Dixon-*et al*., 2003). The high crude fibre density could be attributed to the inherent fibre component of these foods as well as other ingredients used during preparation.

The foods had low vitamin A density when compared to FAO/WHO reference value. This could be as a result of the amounts of the fat used and the levels of vitamin A in the various ingredients used. The high vitamin E content of all these foods except for GA and fish could be attributed to vegetable, palm oil, beans, green leafy vegetables, respectively used in the preparation of these foods. The high zinc density of some of these foods could also be attributed to ingredients used in their preparations. According to investigation by Bates and McClain (1981) zinc deficiency through the inhibition of protein synthesis may affect the tissue availability of micronutrients such as vitamin A and iron, which rely on serum transport proteins. Vitamin A is a well-known antioxidant which is needed by cancer patients to fight oxidative stress associated with cancers.

The high vitamin C density in stew could be attributed to the tomatoes and fresh pepper content of the stew as they are good sources of vitamin C while that of BLS soup could be attributed to its vegetable content. According to the National Cancer Institute (2013), vitamin C may protect against cancer of the oral cavity, stomach and oesophagus and may also reduce the risk of developing cancers of the rectum, pancreas and cervix. It also protects against breast and lung cancer. It is therefore recommended that everybody takes fresh tomatoes liberally.

All the foods had low selenium density. Poor selenium levels especially for men increases cancer risk. Selenium is a component of the antioxidant enzyme glutathione peroxidase that provides protection to organism from oxidative damage. It inhibits prostaglandins that cause inflammation, the P450 enzymes in the liver may be induced by selenium leading to detoxification of some carcinogenic molecules and also it can decrease the rate of tumor growth (Mahan *et al*., 2012). The low selenium density could be attributed to the type of foods prepared. Addition of some good food sources of selenium to these diets could help make up for the inadequacy. The good food sources of selenium that could be added include whole grains and legumes grown in selenium rich soil, sunflower seeds, nuts and brewer's yeast (Mahan *et al*., 2012).

Conclusion: This study has evaluated the diets served to cancer patients in oncology ward in UNTH Ituku/Ozalla, Enugu state, Nigeria. It is evident from the findings, that the dishes served show that most of the foods were adequate (highly nutrient dense) and have potential for control and prevention of all types of cancers if dietary habits are maintained. However, it is important to improve on the vitamin A, selenium and folate content of the dishes as consumed. This could be sourced from local foods (fruits and vegetables) that are rich in the micronutrients.

REFERENCES

American Cancer Society, 2013. Cancer facts and figures 2013. Atlanta. American Cancer Society.

Anand, P., A.B. Kunnumakkara, C. Sundaram, K.B. Harikumar, S.T. Tharakan, O.S. Lai, B. Sung and B.B. Aggarwal, 2008. Cancer is a preventable disease that requires major lifestyle changes. Pharm. Res., 25: 2097-2116.

AOAC, 1995. Official method of Analysis of the Association of Official Analytical Chemists 14th edition. Association of Official Analytical Chemistry, Washington D.C.

Association of Vitamin Chemist, 1966. Methods of Vitamin Assay 3rd edition. Association of Vitamin Chemist, Incorporation, 14: 287-344.

Bates, J. and C.J. McClain, 1981. The effect of severe zinc deficiency on serum levels of albumin, transferrin and prealbumin in man. Am. J. Clin. Nutr., 34: 1655-1660.

Brenner, H., D. Rothenbacher and V. Arndt, 2009. Epidemiology of stomach cancer. Methods in Molecular Biol., 472: 467-77.

Cohen, D.A., 2011. Neoplastic Disease in Nelms,M.N., Sucher,K.,Lacey, K., Roth, S.L. (2011) Nutrition Therapy and Pathophysiology, (2nd Edn). Belmont, USA; Wadsworth, Cengage Learning, 23: 702.

Cohen, J.H., A.R. Kristal and J.L. Stanford, 2000. Fruit and vegetable intakes and prostate cancer risk. J. Nat. Cancer Inst., 92: 61-68.

FAO/WHO, 1996. Preparation and Use of Food Based Dietary Guideline. World Health Organization, Geneva. A report of Joint FAO/WHO consultation Nicosia, Cyprus, pp: 52-55.

Hill, M.M., 1990. Food Guides their development and use. Nutrition Program News U.S Department of Agriculture, Washington D.C., pp: 1-5. Retrieved May 10, 2012 from http://www.greenstone.org.

Ihekeronye, F.I. and P.O. Ngoddy, 1985. Integrated Food Science and Technology for the tropics.Macmillan Publishers Ltd, London and Basing-Stroke.

Kinzler, W. Kenneth, Vogelstein and Bert, 2002. Introduction, the genetic basis of human cancer. New York: McGraw-Hill, Medical Pub. Division, pp: 5.

Kushi, L.H., C. Doyle and M. McCullough, 2012. American Cancer Society Guidelines on nutrition and physical activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. CA Cancer J. Clin., 62: 30-67.

Mahan, L.K., S. Escott-Stump and J.L. Raymond, 2012. Krause's Food and the Nutrition Care Process. (13th Edn.). United States: Elsevier Saunders.

Maziya-Dixon, B., I.O. Akinyele, E.B. Oguntona, S. Nokoe, R.A. Sanusi and E. Harris, 2003. Nigeria Food Consumption and Nutrition Survey 2001-2003. Nigeria: Int. Inst. Trop. Agric. [IITA], pp: 12-16.

National Cancer Institute, 2013. Understanding Cancer. http://cancer.gov/cancer topics/understanding cancer. Retrieved on 17th April, 2014.

Okeke, E.C. and H.N. Ene-Obong, 1995. Nutrient Composition of Conventional Foods as eaten in Northern Anambra State, Nigeria. J. Nutr. in Recipe and Menu Dev., 1: 27-33.

Oniang, R.K., J.M. Mutuku and S.J. Malaba, 2003. Contemporary African food habits and their nutritional and health implications. Asia Pacific J. Clin. Nutr., 123: 201-231.

Onwuka, G.I., 2005. Food Analysis and instrumentation; Theory and practice, Naphtali prints, Surulele Lagos Nigeria.

Osborn, D.R. and P. Voogt, 1978. The Analysis of Nutrients in Foods. London: Academic Press, pp: 166-182.

Park, S., J. Bae, B.H. Nam and K.Y. Yoo, 2008. Etiology of cancer in Asia. Asian Pac. J. Cancer Prev., 9: 371-380.

Pearson, D., 1976. Laboratory techniques in food analysis. Butter worth and co. Ltd., pp: 6-7.

Udofia, I. and I.C. Obizoba, 2005. Effects of sun and shade drying on nutrient and anti-nutrient content of some green leafy vegetables consumed in Uyo communities, Akwa- Ibom state. J. Biochem. Investigation, 3: 1-5.

Vogel, A.I., 1965. Selenium Determination. A textbook of Quantitative Inorganic Analysis, 3rd Edition, pp: 358.

Wicki, A. and J. Hagmann, 2011. Diet and cancer. Swiss medical weekly, 141: w13250.

World Cancer Research Fund/American Institute for Cancer Research, 1997. Food, nutrition and the prevention of cancer: a global perspective. World Cancer Research Fund/American Institute for Cancer Research.