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RESEARCH ARTICLE

A STUDY ON THE PREVALENCE AND MACROBIOTIC APPROACH OF CANCER AMONG THE TRIBAL POPULATION OF SHILLONG

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ABSTRACT

Incidence of cancer in northeast is the highest in India. Nutrition intervention plays a vital role in the management of postponement of cancer.

Objectives to find out the prevalence rate of different types of cancer among the selected tribal population of Shillong and dietary habits of these tribes.

Methods: Three hospitals from the city of Shillong was followed up for a period of three months, a total of 200 inpatients and outpatients visiting during the period were interviewed with well-structured interview schedule to collect data on background information, disease history, anthropometric measurement, clinical assessment, biochemical assessment, lifestyle or health hazards, dietary hazards and dietary assessment including weighment survey to assess for the nutrient intake of the cancer patients for three consecutive days. The PGSGA scoring was done to find the suitable level of intervention strategies. Nutrition intervention through Macrobiotic Approach was given to the patients and their family members using pamphlets, booklet and an e-content.

Results: It was found out during the study that majority of the cancer patients were malnourished. Most of them were non- vegetarian and the rate of health hazards which was recorded among them was high with regards to intake of tobacco, betel nut and intake of alcohol. Dietary hazards also contributes equally towards the risk where it was found out that majority were consuming smoked products and intake of fruit and vegetables was very low among them. On the whole the nutrient intake of the increased selected 20 subsamples was found to meet the RDA except for β- carotene in both the sexes leading to increase chances of oxidative stress.

Conclusion: The study recommends the need of a special nutrition intervention among the selected cancer patients regarding the prevention aspects and motivation of patients to incorporate healthy lifestyle habits into their daily life in which macrobiotic approach was considered a stepping stone to accomplish the objectives.

INTRODUCTION

Non-communicable diseases (NCD) represent a major public health threat to the Universe. Currently, about 26, 500 people die every day from non-communicable diseases in different parts of the world, with over 20 000 of these deaths occurring in the western developing countries. Studies report that half of death due to non-communicable diseases occurs in individuals under the age of 70. Already, non-communicable diseases, notably cardiovascular disease (coronary heart disease and cerebrovascular disease), diabetes, cancer, and chronic pulmonary diseases, account for almost eight out of every 10 deaths in the Western Countries—and the situation is expected to worsen in countries and areas in economic transition if urgent measures are not taken[1].

Cancer alone accounts for 7.6 million deaths worldwide in the year 2008, and the number is projected to rise to 13.2 million deaths in 2030 simply due to the aging and growth of the population. Over 80 per cent of the projected cancer deaths in 2008 were reported among the low-and middle-income countries. A large body of epidemiologic evidence suggests that most cancer deaths are avoidable, although the exact percentages worldwide or for specific parts of the world are not known[2]. Cancer prevalence in India is estimated to be around 2.5 million, with over 8, 00, 000 new cases and 5, 50, 000 deaths occurring each year due to this disease in the country. Unhealthy diets, physical inactivity and overweight are well established risk factor for major non-communicable diseases[3]. There will be approximately 250, 000 new case so for breast cancer in India by 2015. Breast cancer has over taken cervical cancer to become the leading cause of cancer-

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related mortality among women living in metropolitancities. It places the incidence of the diseaseat 20-33per 100, 000 inurbanIndia[4]. The prevalence of different types of cancer among the tribal population of Meghalaya is very near to that of Assam and is high on oesophageal cancer and hypo pharyngeal cancer because of the similar habit of betel-nut chewing with a population of 260, 520.The incidence of cancer among the tribes of Shillong is also at a higher level with a total number of 725 cancer cases registered in 2010 in Shillong alone. Studies on the prevalence of cancer among the tribal population of Shillong is still vary and thus considering the need to eradicate this disease, hence the present study was carried out with the objective to study the prevalence of different types of cancer among the selected tribal population of Shillong, to assess the nutritional status of the selected tribal cancer patients and to identify the underlying causes for the prevalence of cancer with special reference to dietary habits of the tribes[5]**.** It is widely agreed that appropriate dietary habits decrease the risk of cancer. Healthy whole foods that are rich in vitamins, minerals other micronutrients, phytochemicals and antioxidants can counteract carcinogenic effects at the cellular level by combating free radicals. Free radicals are unstable molecules (usually containing oxygen or nitrogen) which can damage normal cells and their DNA through chemical reactions. Antioxidants stabilize these molecules, thereby preventing cell damage; this may slow or prevent the development of cancer. Second, this plant-based diet provides fibre (roughage) for colon health and diet has an important influence on the expression of some cancers.Fruits and vegetables represent untapped reservoir of various nutritive and non-nutritive phytochemicals with potential cancer chemo preventive activity[6]**.**

MATERIALS AND METHODS

Selection of area

With the current tribal population of 2, 60,520, Shillong registered a total of 216 and 509 cancer patients in the month of April-July 2010 and August-December 2010 respectively. Owing to this rapid incident of cancer and also since the investigator herself represents the tribal population of Shillong, this area was selected to study of prevalence rate of different types of cancer.

Selection of subjects

The study comprised of conveniently selected three hospitals with a well-functioning oncology department in and around Shillong exclusively treating cancer patients. The selected three hospitals were followed up by the investigator for the duration of three months, inpatients and outpatients getting treated for the cancer irrespective of age and sex were identified for the conduct of the study using purposive sampling.

COLLECTION OF DATA

Background information

Using a well-structured interview schedule, information regarding the age, sex, education, occupation, income level and family details of the selected tribal cancer patients were elicited. Details regarding the history of the disease, diagnosis made, treatment suggested, type and duration of the disease were obtained from the hospital records as well as from the interview schedule.

Anthropometric measurement

Since the body measurements are an indicator of nutritional status, the parameters like weight, height, waist to hip ratio and BMI were assessed for the selected tribal cancer patients using standard techniques.

Clinical Assessment using PG SGA standards

The assessment of the nutritional status of the selected tribal cancer patients was done using the Patients Generated Subjective Global Assessment standards developed for the cancer patients. The PGSGA scoring is a good indicator of nutritional status of cancer patients and recommends dietary intervention based on the Triage Recommendation. The scoring as such was based on the parameters like weight loss, criteria for condition, physical examination and metabolic stress (worksheet 1-4).

Triage Recommendation

The individual score obtained from the PGSGA score (worksheet 1-4) was added and were then rated using triage standard score. Based on the score obtained, the nutritional interventions to be given were then interpreted according to the triage recommendation.

Biochemical parameters

For assessing the biochemical status, a sub sample of 20 tribal cancer patients (10 male and 10 female) were selected at random and biochemical test like SGOT, SGPT, blood count like WBC and RBC, sodium and potassium for electrolyte balance, random blood sugar and hemoglobin level were assessed and compared with standards.

Lifestyle behavior

The lifestyle behavior of the selected cancer patients like smoking, alcohol consumption, pan/ betel nut chewing, occupational stress/hazards and their exercise pattern were collected using interview schedule.

Dietary habits

Using the same interview schedule, dietary pattern of the tribal cancer patients was elicited by obtaining information with regards to their present diet history, meal frequency, method of cooking, types of oil used, excess intake of non-vegetarian foods (including smoked or charred meat intake), reuse of oil, inclusion of food additives or artificial colorings or preservatives, intake of antioxidant rich fruits and vegetables. The quantum and frequency of consumption of tea, coffee and fresh fruit juices were also recorded. A food frequency table for the five food groups was also done for selected tribal cancer patients.

Nutrient intake

Out of 124 male and 76 female tribal cancer patients identified a subsample of 10 male and 10 female tribal cancer patients were randomly selected to study their nutrient intake. A three

days weighment survey was done. The food intake of the subjects was weighed both in raw and cooked form before and after cooking and eating. The leftover food on the plate was also weighed. The cooked volume of the actual food intake was then converted into raw equivalent. The nutrient intake was calculated for both micro and macro nutrients using NIN table of nutritive value for Indian food. The computed nutrient intake was then compared with the RDA of ICMR of Indian foods for nutrient adequacy for normal sedentary male and female. The data collected was treated using appropriate statistical tool.

Nutrition intervention

Based on the triage recommendation and the observation during the study, the investigator had developed a pamphlet, booklet and e-content to serve as an aid for imparting nutrition education to each of the in and out tribal cancer patients and their family members. Counseling was given to manage cancer through macrobiotic approach projected in an e-content and also distributed to all the developed pamphlets and booklets. Macrobiotic approach is a holistic approach towards defineding a life with all the required aspects to stay healthy which includes dietary modification, lifestyle modification, behavioural modification, stress modification and finally spiritual modification. These are the aspects which according to the Macrobiotic Approach could help an individual lead a healthy and prosperous life in conjugation with living in harmony with nature.

RESULTS AND DISCUSSION

Background details

- The sporadic increase in the incidence of cancer was observed from the age group of 30 years and above. The incidence was higher between the age group of 40-50 years for women (27 out of 76 subjects) and 50-60 years for men (40 out of 121 subjects). The above finding are in lieu with the study conducted by Igor Akuchevic (2008) who claims an incidence rate of 80 per cent of cancer being diagnosed in elderly males[7].
- Majority of the selected tribal cancer patients (male-104 and female-61) lived in a nuclear family and the remaining 20 male and 15 female lived in a joint family.
- Only 13 selected tribal cancer patients (men-7, women-6) lived in small families and the rest of the subjects lived in large families.
- Out of 121 tribal males and 74 tribal female cancer patients selected, 119 tribal males and 65 tribal females were married.
- Sixteen tribal cancer patients (male -13, female- 3) were found to be illiterates. Among the literates, 39 males and 28 females were under graduates and 19 patients (male-9, female-10) have completed their post-graduation. The same scenario was reported by *Spadea et al.* (2009)-which indicates that less-educated men had higher risks of upper aero-digestive tract, stomach, lung, liver, rectal, bladder, central nervous system and ill-defined cancers, and lower risks of melanoma, kidney and prostate cancers. Women with lower educational levels were at higher risk of stomach, liver and cervical cancers, whereas they were less likely to be diagnosed with melanoma, ovarian and breast cancers. For most sites, the educational gradient in risk did not vary substantially over time[8].
- Seventy six selected tribal cancer patients (male-55, female-21) were found to be labourer (manual worker).Also 48 males and 33 females were found to be executives.
- Sixty one males and 21 female selected tribal cancer patients belonged to economically weaker section (table I)with their monthly earning less than Rs 3000. While 50 males and 36 females belonged to a high income group with a monthly earning more than rupees ten thousand. Low socio-economic status is significantly associated with increased cancer risk in high and lower income-countries, across the world[9].

Table 1. Income status of the selected tribal cancer patients

INCOME STATUS	TOTAL BOYS/MEN (n=124)	TOTAL GIRLS/FEMALE (n=76)
Economically Weaker Section (<3000)	61	21
Lower Income group (3000-7000)	7	9
Middle Income Group (7000-10000)	6	10
Higher Income Group (>10000)	50	36
TOTAL	124	76

- **Prevalence of different types of cancer among the tribes of Shillong:** Out of 124 tribal male cancer patients and 76 female cancer patients, 52 male and 21 female were suffering from oesophageal cancer. Throat cancer was observed among 32 male and nine female. Oral cancer was reported among nine male and ten female, similarly, stomach cancer was recorded among eight male and four female.Age increases the risk for oesophageal cancer and the disease is more common after the age of 50. Risk for developing cancer of various types is about three times higher in men. In developing countries, major risk factors of oesophageal, stomach, throat, oral and several other forms of cancer include nutritional deficiency associated with lack of fresh fruits and vegetables, regular consumption of very hot beverages, regular ingestion of fermented vegetables, smoking, alcoholism and chewing tobacco[10].

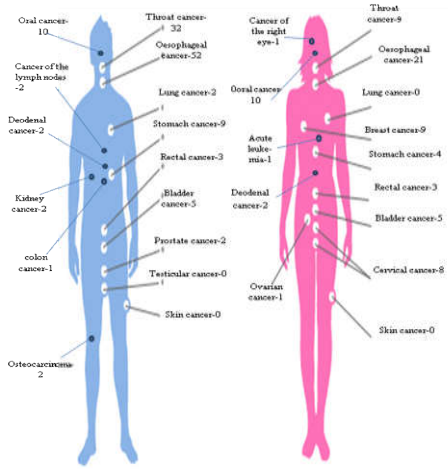


Fig.1. Prevalence of cancer among the selected tribal cancer patients of Shillong

- **Symptoms experienced:** The most common symptoms experienced by the selected tribal cancer patients (table II) were pain over the region/sites of cancer (110 male and female 76), followed by weight loss (91 male and 48 female) and indigestion (77 male 39 female).Other symptoms like fever, nausea and vomiting, fatigue and depression, irritability, loss of appetite, constipation/diarrhoea, bleeding, night sweat, obvious change in moles and lump in the mouth or ulcer were found to be less common among the subjects.

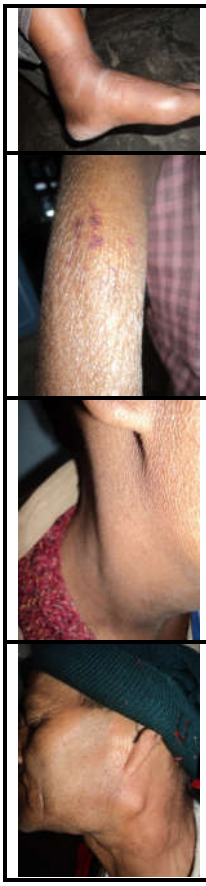
between the BMI and the prevalence of different types of cancer at 5 per cent level of significance.

Table 3. BMI of the selected cancer patients

BMI	MALES (N=122)	FEMALES(N=74)
Underweight (<18.5)	43	20
Normal (18.5-25.0)	77	53
Overweight (25-30)	1	Nil
Obese (>30)	Nil	1
Correlation	0.1485*	

*Significant at 5 per cent level

Table 2. Symptoms exhibited by the cancer patients



SYMPTOMS	TOTAL	
	BOYS/MEN (n=124)	GIRLS/WOMEN (n=76)
Pain over any region	110	76
Fever	11	16
Nausea and vomiting	30	28
Weight loss	91	48
Fatigue and depression	30	20
Constipation/diarrhoea	5	9
Bleeding	9	7
Irritability	35	14
Night sweats	1	nil
Loss of appetite	34	39
Obvious change in mole	5	nil
Indigestion	77	39
Lump in the breast	Nil	5
Lump in the mouth or ulcer	11	10

- **Treatment:** Forty nine tribal male cancer patients and 31 female cancer patients were treated for cancer through radiation and chemotherapy. Twenty males and eight females underwent radiation therapy alone. Further thirteen cancer patients (nine males and four females) had a combination of treatment which included surgery, followed by chemotherapy and radiation therapy.
- **Feeding problems:** The common form of feeding problems experienced by the tribal cancer patients was indigestion (73 male and 46 female) and loss of appetite 46 male and 36 female. Least number of cancer patients (male 20, female seven) complained of sore throat.

Anthropometric measurement:

- **BMI:** Out of 124 tribal male cancer patients and 76 female cancer patients, 43 men and 20 women were found to be underweight (table III). Except for one male, the rest of the subjects had normal BMI and none of the male's subjects were found to be obese. The correlation analyses showed a significant positive association
- **Waist to hip ratio:**Sixty seven selected tribal cancer women had waist hip ratio (WHR) above 0.85 thus indicating higher risk for cancer, CVD and other non-communicable disease, whereas 119 tribal cancer patients had lower risk of developing the same.

Clinical assessment

- **Weight loss:** Twenty five male tribal cancer subjects including two boys, and thirty four females including two girls lost 0-4 kg of weight within a period of one month (table IV). Four subjects(three males, one female) lost 4-8 kg of weight within one month. Whereas, 57 cancer patients (male 45, female 12) lost 4-8 kg over a period of 6 months and 69 subjects (40 male, 29 female) lost more than 4-8 kg over the period of six months.

Table 4. Weight loss of the selected cancer patients

WEIGHT LOSS IN 1 MONTH			WEIGHT LOSS IN 6 MONTHS		
Score	Boys/Men (N=124)	Girls/Women (N=76)	Score	Boys/Men (N=124)	Girls/Women (N=76)
2	1	Nil	2	Nil	nil
1	3	1	1	45	12
0	25 (2 boys)	34 (2 girls)	0	40	29
Total	28	35	Total	95	41

*4(loss of 16-20kgs in one month); **3(loss of 12-16kgs in one month), ***2 (loss of 8-12kgs in one month); ****1 (loss of 4-8kgs in one month), *****0 (loss of 0-4kgs in one month)

Table 5. Physical examination

PARAMETER SCORE	BOYS/MEN (n=124)	GIRLS/WOMEN (n=76)
FAT STORE	9	5
3	42	14
2	41	20
1	27	37
0		
MUSCLE STATUS	10	4
3	47	13
2	37	24
1	25	35
0		
FLUID STATUS	Nil	Nil
3	8	Nil
2	6	1
1	103	75
0		

*3(severe deficit), **2(moderate deficit), ***1(mild deficit), ****0(no deficit)

- **Fat stores:** Nine males and five female tribal cancer patients had severe deficit of fat stores. Likewise 42 males and 14 females showed moderate deficit of fat store, further it was observed that 27 males and 37 females did not show any deficit for fat store.
- **Muscle status:** In case of muscle status 14 selected tribal cancer patients (10 males, four females) had severe muscle deficit, 60 cancer patients (47 males, 13 females) showed moderate muscle deficit, and mild deficit in muscle status was observed among 61 (37 male and 24 female)cancer patients. The prognostic significance of weight loss in cancer patients is well established. Weight loss is strongly associated with poor outcomes from the earliest disease stages through to advanced cancer. The negative nitrogen balance underlying cancer cachexia leads to a significant wasting of skeletal muscle. Muscle loss reduces patient mobility, jeopardizes respiratory function, relates to reduced immunity, and is associated with poor performance status and outcomes[11].
- **Fluid status:** Eight male tribal patients showed moderate fluid accumulation, and remaining 178 cancer subjects (103 males, 75 females) revealed no sign of fluid accumulation. As cites was witnessed among six male and one female.
- **Metabolic stress:**Out of 200 tribal cancer patients two male and two female had a severe metabolic stress whose body temperature was more than 102^{o}F for more than 72 hours, and were on a high dose of steroids. Further 114 male and 64 female did not experienced any metabolic stress and were free from steroids dosage.
- **Triage recommendations:** Score obtained by 96 male and 40 female tribal cancer patients for triage recommendation indicated need for critical nutrient intervention to manage the symptoms of the disease.
- **Biochemical assessment:** Out of 20 subsamples, three male and four female had elevated SGPT level and similarly two male and three female showed elevated SGOT indicating a poor nutritional status and liver function. Further six female and five male were reported to have abnormal Complete Blood Count. Hyperglycaemia was seen among seven tribal male cancer patients and six female. All the 20 subsample were found to be anaemic with the total haemoglobin level below the recommended standard of (13-18mg/dl for male and 12-16 mg/dl for female) which can be attributed to the poor nutritional status owing to disease condition.

Lifestyle or health hazards:

- **Consumption of tea and coffee:** Fifty three males and 30 tribal female cancer patients consumed tea, followed by flavoured tea (48 males, 27 females). None of the subjects consumed green tea and lemon tea. It was also observed that none of the subjects consumed more than two cups of coffee/tea day.

Table 6. Biochemical Assessment

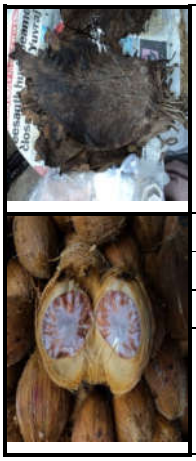
GENDER	PARAMETERS															
	LFT				CBC				Electrolytes				RBS		Hb	
	SGOT (Upto 30 units)		SGPT (Upto 40 units)		RBC 4.2-6.9million/µL/cu mm		WBC 4300-10, 800cells/ µL/cu mm		Na Na-136-146mEq/L		K K-3.7-5.2mEq/L		80-110gm/dl		(M=13-18gm/dl) (F=12-16gm/dl)	
	A	N	A	N	A	N	A	N	A	N	A	N	A	N	A	N
MALE (n=10)	4	6	2	8	5	5	6	4	5	5	7	3	7	3	10	NIL
FEMALE (n=10)	3	7	3	7	6	4	3	7	6	4	8	2	4	6	10	NIL

A – Abnormal; N – Normal

Table 7. Types, duration and quantum of smoking

TYPES	DURATION		AMOUNT SMOKED PER DAY		TOTAL
	4 Years	5 Years	4-8/ day	>10/ day	
Beedi	Nil	13	3	10	**13**
Cigarette	Nil	59	2	57	**59**
Pipes	1	14	2	13	**15**
Cigar	Nil	Nil	Nil	Nil	**Nil**
Cigarette/beedi	Nil	14	3	11	**14**

Table 8. Types, quantum and duration of consumption of betel -nut/tobacco



Types	Duration >5 years		Amount consumed per day										Total	
	M	F	1-3/ day		4-6/ day		6-10/ day		>10/day		Rarely		M	F
			M	F	M	F	M	F	M	F	M	F		
Tobacco	6	17	1	2	2	4	1	3	1	7	1	Nil	**6**	**17**
Betel nut	93	7	3	1	5	2	11	4	74	1	Nil	Nil	**93**	**7**
Tobacco /betel nut	23	50	2	2	2	3	5	2	14	43	Nil	Nil	**23**	**50**
Total	**122**	**74**	**6**	**5**	**9**	**9**	**17**	**9**	**89**	**51**	**1**	**Nil**	**122**	**74**

Table 9. Types, quantum and duration of alcohol consumption

Types of alcohol	Duration of consumption >5years	Amount of alcohol consumed per day >60 ml/day	250 ml/day	400 ml/day	>400 ml/day	Total
Rum	1	Nil	Nil	Nil	Nil	1
Whisky	40	4	3	7	26	40
Others	24	2	2	7	13	24
Beer/whisky/rum	2	Nil	Nil	1	1	2
Beer/whisky/others	2	1	1	Nil	Nil	2
Whisky/rum/others	9	Nil	1	3	5	9
Whisky/others	11	1	2	1	7	11
Whisky/rum	12	3	4	2	3	12
Beer/whisky	3	Nil	1	Nil	2	3
Total	104	12	14	21	57	104

- **Smoking:** Out of 124 subjects 101 male tribal cancer patients were found to be smoking for the past four years (table VII). Ninety one out of 101 male cancer patients smoked more than 10 cigarettes /day, a number which is a known risk for cancer/cardiovascular disease.
- **Tobacco and betel nut chewing:** Except for four cancer patients two each from male and female, the rest of the tribal patients (male 122 and female 74) were found to be using tobacco/ betel nut or a combination of both tobacco and betel nut together over the past few years (table VIII). Chewing of betel nut was seen more among the males (93) compared to female. Eighty nine male and 51 female cancer patients chewed either tobacco/betel nut or both for more than ten times a day. According to WHO (2009), although a substantial proportion of the cancers are caused by the tobacco rather than the betel nut and leaves in the quid, betel chewing without tobacco also leads to cancer of the mouth[12].

- **Alcohol consumption:** On the whole 101 male tribal cancer patients were found to be alcoholic (table IX). Commonly consumed variety of alcohol drinks by the male cancer patients were whisky (40) and local made rice beer (24 subjects). It was found that 21 males consumed up to 400ml of either whisky/ local made rice beer alcohol per day and 57 of the male subjects consumed >400ml/day. The alcoholic were found to be addicted for more than five years.
- **Exposure to carcinogens:** Out of 124 male 101 male tribal cancer patients who smoked were likely to be exposed to tar a carcinogenic substance found in cigarettes.
- **Condition of working or dwelling places**: Eighteen male subjects and five female tribal cancer patients were working in a poorly ventilated environment, whereas, one male and two female experienced heavy exposures to UV rays.
- **Stress experienced:** On observing the related stress parameter it was found that most of the selected tribal cancer patients (60 male and 45 female) were frustrated and depressed very often, which was followed by fear and anger (31 male and 14 female). The release of hormone cortisol in response to physical or psychological stress potentially reduces the function of the immune cells there by influencing the growth of cancerous cell or tumour cell[13].
- **Dwelling and working places:**It was observed that maximum number of the tribal cancer patients representing the tribal population of Shillong were mainly living in the urban areas namely Nongshilling, Jaiaw, Mawlai, Nongthymmai, Laitumkhrah, Laban and Nongrimbah. Only 50 male and 21 female cancer patients belonged to different rural parts of Shillong.

Dietary hazards

- **Intake of smoked meat:**All the subjects irrespective of sex were found to be non-vegetarian, one hundred male and 68 female consume smoked meat. Frequent consumption of nitrate from animal sources is associated with increased risk of pancreatic cancer. Dietary sources of nitrate include cured, smoked or pickled meats and fish, dried meats, cooked bacon, non-fat dry milk and other protein foods cooked at high temperatures or those preserved with nitrite[14].
- **Reuse of oil:** Reuse of cooking oil was reported among 77 male and 57 female tribal cancer patients. Reuse of oil is very harmful for health. The more you reuse cooking oil, the more saturated fatty acids get in to our body. Reusing oil causes oxidation-a chemical reaction between oxygen and oil which damages the oil structures in such a way that it becomes detrimental to our health and is known for causing some form of cancer as well[15].
- **Low consumption of anticancer foods:** On the whole poor intake of fruits and vegetables was witnessed among the selected tribal cancer patients. Daily consumption of fruits was reported only among 37 out of 124 male and 27 out of 76 female.

Dietary habits

- **Meal frequency:** Ninety out of 124 male and 63 out of 76 female followed two meal pattern revealing skipping of meal of either breakfast/lunch/ or dinner.
- **Past and present dietary habits:**One hundred and fourteen males and 69 females had switched on to a better dietary pattern to cope up with the disease. On the whole 17 subjects did not alter their dietary habit even after their treatment for cancer.
- **Cooking methods:** Boiling was practised by 107 male and 68 female selected tribal cancer patients. Next to boiling smoking of meat was predominant among 100 male and 68 females. Poaching of egg /vegetables was not practised by any of the subject. Deep-frying, was observed among 92 male and 73 female. Dry method of cooking such as grilling or broiling result in production of carcinogens like HCAs (or heterocyclic amines) and acryl amines is similar to deep fat frying[16].
- **Oil consumption:** Mustard oil was used by all the tribal cancer patients for cooking. Twenty nine male and 17 female used sunflower oil in addition to the mustard oil. Usage of the beneficial oil particularly polyunsaturated fat like safflower, olive and sesame oil was not at all used by the subjects.
- **Cereals consumption:** It was noted that rice being the staple food of the people in Shillong cent per cent of the tribal cancer patients consumed rice on a regular basis, followed by this 17 male and 12 female consumed maize or corn mainly in the boiled and roasted form. It was surprising to note that only very few subjects consumed fibre rich grains like wheat and oats. Grains like jowar, barley and ragi were not consumed by any one of the subjects.
- **Vegetables consumption:** Vegetable consumption among the male and female tribal cancer patients of Shillong was very poor. Except for onion, garlic and ginger, the green leafy vegetables rich in antioxidant were consumed by less than 20 subjects (both male and female).Beneficial pulses like soy bean (32 male and 27 female) and kidney beans (30 male and 32 female) were consumed only once in a month.A diet with adequate portions of green leafy vegetables and fruits ensures an intake of roughage or fibre. This has been shown to have beneficial effects on a number of cancers, notably cancers of the colon and rectum[17].
- **Consumption of pulses:** On the whole the intake of different types of pulses was very poor among the selected tribal cancer patients. Popular pulses like red gram dhal, black gram dhal, green gram dhal and Bengal gram dhal were very rarely used in preparation like dhal soup and dhal fry. Beneficial pulses like soy bean (32 male and 27 female) and rajmah (30 male and 32 female) was consumed once in a month. The poor intake of pulses can be attributed to the replacement of fleshy foods on the daily basis.
- **Consumption of nuts and oilseeds:** Only one male and five female tribal cancer patients consumed almond, a rich source of antioxidants. Tree nuts, including cashews, pistachios, almonds, hazelnuts, pecans, and walnuts are nutrient rich foods high in a number of beneficial compounds that promote health and reduce the risk of some chronic diseases including cancer. Research conducted in the past decade indicates that a class of compounds called phytochemicals, which include carotenoids, phenols and proanthocyanidins are particularly important contributors to these effects[18].

Table 10. Nutrient intake between male and female cancer patients

GENDER	NUTRIENT	MEAN±S.D	DIFFERENCE	t-value
Male	Energy (kcal)	1942±389.03	228.30	1.3040 NS
Female		2171±393.95		
Male	Protein (gm)	57.00±15.06	0.40	0.0731 NS
Female		56.60±8.50		
Male	Fat (gm)	71.60±19.92	12.40	1.2683 NS
Female		84.00±23.64		
Male	Carbohydrate(gm)	278.10±19.80	4.00	0.3070 NS
Female		282.10±36.13		
Male	Iron(mg)	15.06±3.41	3.95	1.6104 NS
Female		19.01±6.97		
Male	β-carotene(µg)	1537.99±875.68	198.61	0.5857 NS
Female		1736.60±619.01		
Male	Vitamin c (mg)	81.43±23.70	38.43	3.0087 **
Female		119.86±32.71		
Male	Calcium (mg)	540.04±249.13	82.53	0.9087 NS
Female		622.57±142.89		
Male	Thiamine (mg)	1.10±0.50	0.06	0.3501 NS
Female		1.04±0.20		
Male	Riboflavin (mg)	1.13±0.38	0.09	0.5352 NS
Female		1.04±0.3688		
Male	Niacin (mg)	13.33±2.71	0.66	0.6624 NS
Female		13.99±1.61		

*-Significant at 5 per cent level, **- Significant at 1 per cent level, NS –Non-significant

- **Consumption of meat/poultry and sea food:**Hundred and eighteen male and 73 female cancer patients consumed red meat. Daily consumption of fish was observed to be comparatively less among both the sexes (male 76 and female 55) over the meat and poultry consumption.
- **Consumption of fruits:**Fruit consumption among the tribal cancer patients was found to be very poor in general. Orange was consumed daily by only 31 patients (male 18, female 13). The other fruits like kiwi, melon, peaches, apple, plum, guava, papaya and mango were consumed either once in a week or once in a month.
- **Nutrient intake:** The mean calorie intakes for calorie, niacin and vitamin C for the selected female cancer patients were significantly higher than the recommended dietary allowance at 1 per cent level of significance. Likewise a deficit intake for β- carotene was noted at 1 per cent level of significance strongly suggesting increased chances for oxidative damage of cells due to inadequate antioxidants (table X).
- The mean calorie intakes for calorie, fat, protein, niacin and vitamin C for the male selected tribal cancer patients were significantly higher than the recommended dietary allowance at 1 per cent level of significance. Likewise a deficit intake for β- carotene was noted at 1 per cent level of significance.
- The mean nutrient intake for vitamin c of the selected tribal male and female cancer patients was significantly higher than the normal recommended dietary allowance at 1 per cent level of significance. Further there was no significant difference in the mean nutrient intake for both macro and micro nutrients between selected male and female cancer patients.

Summary and conclusion

It was observed that there was not much difference in the nutrient intake between male and female cancer tribal patients. Though the nutritional requirement of the cancer patients for both macro and micro nutrients was high, the selected cancer patients except for β- carotene met the RDA for sedentary men/women. Nutrition assessment carried out by the investigator has to a certain extend identified the potential causes and the problems encountered by the cancer patients and served as a basis for framing the contents for nutrition intervention. The macrobiotic Approach which was adopted as a means of nutrition intervention for the selected tribal cancer patients in the form of pamphlet, booklet and a PowerPoint presentation insisting the strategies for managing cancer among the selected cancer patients will serve as a beneficial guide to retrieve whenever necessary.

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