Effect of Diet Counseling on Anthropometric Indices and Dietary Intake of the Head and Neck Cancer Patients Undergoing Chemo-Radiotherapy

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Abstract: Malnutrition is common in patients with head and neck cancer due to cancer cachexia, anti-cancer therapies, impairment in food intake due to the tumor etc. This study aims at studying the effect of diet counseling intervention on dietary intake and anthropometric indices. Experimental design with only one experimental group was conducted on 14 head and neck cancer patients who were admitted for chemo-radiotherapy. Detailed assessment of anthropometry and diet was done in the before, during and after the diet counseling intervention of 7 weeks. There was mean weight improvement of 2 kg (p<0.001) during the intervention period that can be attributed to a significant increase in the dietary intake of energy (p=0.034), protein (p=0.011), calcium (p<0.001), zinc (p=0.041), vitamin C (p=0.046) and vitamin A (p=0.019). However there was no statistically significant improvement in the mid-upper arm circumference (MUAC). This increase may be a sign of improvement of nutritional status as normally cancer patients tend to show a decrease in MUAC. This indicates the success of the diet counseling intervention. An even greater improvement in these parameters can be achieved if intervention is provided before the initiation of chemoradiotherapy and has to be continued even after the therapy is complete.

Keywords – Head and neck cancer, malnutrition, diet counseling, changes in anthropometric indices, changes in dietary intake.

INTRODUCTION

Malnutrition is common among the patients with head and neck cancer undergoing chemoradiotherapy (CRT). This is attributed to tumor type, site of the tumor, anti-cancer treatment; various symptoms the patients develop during the treatment which ultimately leads to the reduced food intake and weight loss of the patients. In 2011, there were 6,767 new cases of oral cancer in the UK: 4,510 (67%) in men and 2,257 (33%) in women, giving a male: female ratio of around 20:10. The crude incidence rate shows that there are 15 new oral cancer cases for every 100,000 males in the UK, and 7 for every 100,000 females[ ]. Malnutrition is the most common comorbidity in cancer patient population. Studies have demonstrated that anywhere from 30% to 87% of cancer patients are diagnosed with malnutrition with 30-60% of cancer patients diagnosed with protein calorie malnutrition with higher rates of as much as 80% in

esophageal cancer patients[ ]. Anticancer treatments like radiation therapy, chemotherapy or combination therapy i.e. chemoradiotherapy may have an adverse effect like weight loss, xerostomia, loss of taste, impaired swallowing function, mucositis, pharyngitis, nausea and vomiting that can adversely affect the food intake of a person. In a study it shows that the toxic effects can lead to grade 3 or higher mucositis in the majority of patients undergoing chemoradiotherapy (CRT), whilst only 20% to 30% of patients treated with conventional radiotherapy (RT) alone will develop mucositis[ ]. Another study shows that in addition to general symptoms caused by cachexia, such as loss of appetite, early satiety and changes in smell and taste, head and neck cancer patients often suffer from oral symptoms, caused by the tumor, or as a side effect of head and neck cancer treatment. The most common oral symptoms include taste disturbances [ ]. Weight reduction up to 5% or more is mostly conspicuous among the patients due to cachexia as well as due to anti-cancer treatment. A cross sectional study conducted on 112 patients with oral cancer showed that a mean decline of approximately 3kgs of body weight was observed among the patients pre-treatment and they claimed that the weight loss among the patients were mostly caused by the swallowing problem.[ ] Apart from that, reduction in mid-upper arm circumference (MUAC) which is a great indicator of muscle wasting is noted among these patients. More or less all the patients with head and neck lose weight and have a drop in nutritional status. Thus, nutritional screening is very important for these kinds of patients to detect malnutrition at an early stage. [ ]The Oncology Nutrition Dietetic Practice Group of the American Dietetic Association adopted the Scored PG-SGA as a standard nutrition assessment tool for cancer patients.[ ] A study shows that early nutrition intervention in patients with HNC (Head and Neck Cancer) receiving chemoradiotherapy resulted in an improved treatment tolerance and fewer admissions to hospital[ ]. Thus, nutritional counseling seems to be effective in the betterment of the overall health status of the patient. It helps to replenish the nutrient losses in the body and also helps to gain weight slowly but effectively as it improves the food intake of the patients. The patients' anthropometric as well as biochemical parameters may tend to improve after diet counseling as it improves their intake and ultimately the quality of life yet it takes an extended period of time to show the improvement.

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METHODOLOGY

Objective: The main objectives of the study are to determine the effect of nutritional intervention on the dietary intake and the anthropometric indices of the affected head and neck cancer patients undergoing chemoradiotherapy.

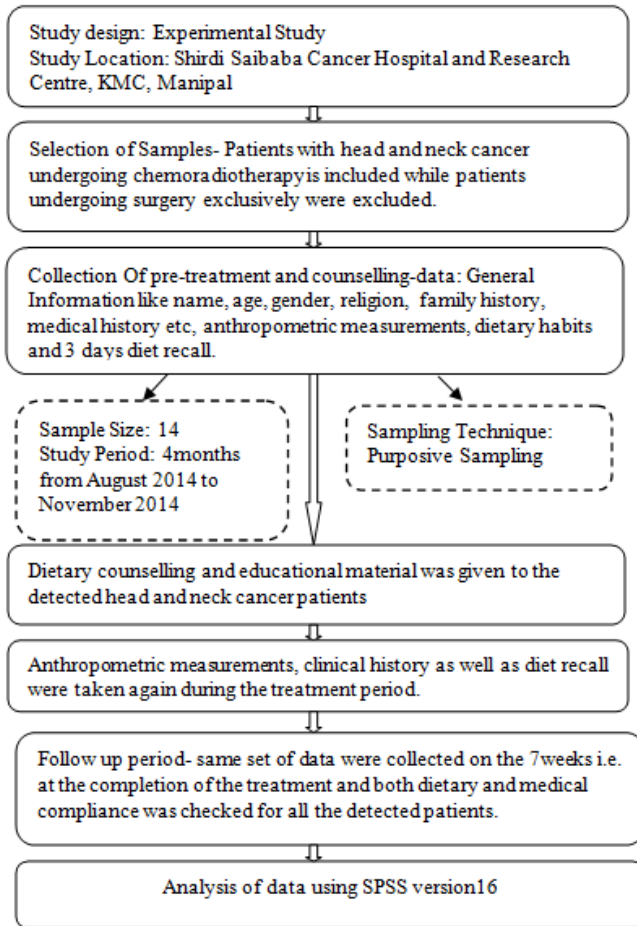The methodology of the study is shown in a schematic diagram below:

Study design: Experimental Study
Study Location: Shirdi Saibaba Cancer Hospital and Research Centre, KMC, Manipal

Selection of Samples- Patients with head and neck cancer undergoing chemoradiotherapy is included while patients undergoing surgery exclusively were excluded.

Collection Of pre-treatment and counselling-data: General Information like name, age, gender, religion, family history, medical history etc, anthropometric measurements, dietary habits and 3 days diet recall.

Sample Size: 14
Study Period: 4months from August 2014 to November 2014

Sampling Technique: Purposive Sampling

Dietary counselling and educational material was given to the detected head and neck cancer patients

Anthropometric measurements, clinical history as well as diet recall were taken again during the treatment period.

Follow up period- same set of data were collected on the 7weeks i.e. at the completion of the treatment and both dietary and medical compliance was checked for all the detected patients.

Analysis of data using SPSS version16

Table I Cut Off Range Of Compliance

Compliance %	Class
<40	Low Compliance
40-69	Moderately Compliance
>70	High Compliance

RESULTS

14 patients detected with head and neck cancer were enrolled in this experimental study design. Their ages were classified into 3 categories i.e. <35years as young adults, 35-65 years Middle Age and >65 years as old age. Among these 14 patients, majority of the patients (6) falls in the Middle age group category. About 13(92.9%) patients out of 14 were male, and only 1(7.1%) patient was female affected with head and neck cancer. Socio-economic status of the patients was determined using Kuppuswamy scale 2012. Based on the education and the occupation of the head of the family as well as the income of the whole family, the socioeconomic status of the patients has been determined. Majority of the patients i.e. about 6 (42.9%) patients fall under the category of Lower Middle Class III but only 1 patient falls under the category of Upper Class I. Rest about 2(14.3%) patients fall under Upper Lower Class IV and about 3 patients fall under the category of Upper Middle Class.

The cancer treatments i.e. Chemotherapy or Radiation therapy or the combination of both are cost effective. So the affordability of the patients for the cancer treatment can be determined by their socioeconomic status.

Medical assessment of the detected patients includes personal medical problem(s), family history and the treatment they are undergoing. Majority of the patients i.e. 7(50%) out of 14 were detected with Cancer of Mouth, 5(35.7) of them were having Cancer of Throat whereas the rest of the 2 (14.3%) patients were detected with Cancer of Neck.

Anthropometric measurements mainly Weight, Height and MUAC of all the 14 patients were taken first before treatment, during treatment and after treatment. The mean weight of all the detected head and neck cancer patients was found to be 52.51kg. Majority of the patients i.e. about 10(71.4%) out of 14patients were having Normal BMI whereas only 3(21.4%) patients were categorized as Underweight and only 1(7.1%) patient were categorized as Pre-Obese according to the Asian Classification of BMI. MUAC has been classified into two categories i.e. Malnourished and Normal. The majority of the patients 9 (64.3%) were normal whereas 5 (35.7%) were categorized as malnourished.

Almost, all the detected head and neck cancer patients exhibit clinical signs and symptoms like headache, dizziness, nausea or vomiting, pain in the mouth, throat, neck, chewing and swallowing problem, loss of appetite etc. These clinical signs and symptoms classified based on the degree of severity i.e. Mild, Moderate, Severe & Very severe. The Clinical Symptoms score was calculated by assigning the highest score to very severe and lowest score to mild symptoms. The sum total is further classified as <5 points to mild, 5 – 17 as moderate, 18 – 27 as severe and more than 28 points as very severe. Most of the patients i.e. about 8 (57.1%) were having moderate signs and symptoms, 5 (35.7%) patients were having mild symptoms and only 1(7.1%) patient had severe clinical symptoms before the initiation of the treatment. The CRT-induced dysphasia, odynophagia, loss of sense of taste, xerostomia, nausea, vomiting and loss of appetite may have a significant negative impact on nutrition and functional ability leading to malnutrition.

The nutritional status of all the detected head and neck cancer patients was determined with the help of a nutritional screening tool i.e. PGSGA (Patient Generated Subjective Global Assessment) tool. The patients were classified under 3 different stages i.e. Stage A – Well nourished, Stage B –

Moderately malnourished and Stage C – Severely malnourished. They were classified with respect to their health condition and the scores given to them after assessing their health condition. About 3(21.4%) patients were classified under Stage A. 11(78.6%) out of 14 head and neck cancer patients were classified under Stage B.

Effect of dietary counseling has been observed based on the following aspects given below:

a.   Anthropometry
b.   Dietary Intake

Effect Of Diet Counseling On Anthropometric Indices Of The Detected Head And Neck Cancer Patients

Table II. shows the comparison between the pre, during and the post anthropometric measurements of all the patients using the test of Repeated Measures ANOVA.

Table III. shows the pairwise comparison between pre, during and post anthropometric measurements of all the patients using the test of repeated measures.

The tables II &III depict that when using ANOVA with repeated measures with a Greenhouse – Geisser correction as well as in the pairwise comparison the mean scores of weight were statistically significant (F(1.261, 16.395) = 6.692, p=0.015) at 5% level where the reduction is observed in mean weight during the treatment i.e. 50.06kg when compared with mean weight (52.51kgs) before the treatment initiation whereas the mean post weight was slightly increased i.e. 50.53kg than the mean weight during the treatment. Similarly, the mean scores of BMI also seemed to be statistically significant (F(1.261, 16.398)=7.142, p=0.012) at 5% level with the changes in

Table III Pair-wise Comparison Of The Anthropometric Measurements

Anthropometry		Mean Difference(I-J)	p-value
Weight			
Pre	During	2.451	P<.001**
	Post	1.976	.112 NS
During	Pre	-2.451	P<.001**
	Post	-0.476	1.000 NS
Post	Pre	-1.976	.112 NS
	During	0.476	1.000 NS
BMI			
Pre	During	.917	P<.001**
	Post	.723	.101 NS
During	Pre	-.917	<.001**
Post	Pre	-.723	.305 NS
	During	.194	.296 NS
MUAC			
Pre	During	.309	.237 NS
	Post	.094	1.000 NS
During	Pre	-.309	.237 NS
	Post	-.214	1.000 NS
Post	Pre	-.094	1.000 NS
	During	.214	1.000 NS

**significant at 1% level, *significant at 5% level, NS Non significant

Effect Of Diet Counseling On Dietary Intake Of The Detected Head And Neck Cancer Patients

Effect of dietary counseling has been observed on the nutrient intake of all the detected head and neck cancer patients.

Both the tables IV and V represent the comparison between the pre, during and the post nutrient intake of all the head and neck cancer patients using the test of Repeated Measures, ANOVA.

The mean scores of energy intake was statistically significant (F(1.578,20.518)=4.350, p=0.034) at 5% level, as the intake had dropped during the treatment but significantly increased as the treatment terminates. The pre mean protein intake was 44.45gm, which had reduced non-significantly during the treatment i.e. 43.60gm but increased significantly post treatment to58.87gm. So the mean scores of protein intake was showing a significant difference (F (1.423,18.50) =6.839, p=0.011) at 5% level. Though the mean intake of carbohydrates seemed to increase slightly among the patients, it is not showing any significant difference. Similarly, fat intake has decreased among the patients post treatment and diet counseling but is not showing any significant difference. Among the micronutrients, the mean score of calcium (F (1.667, 21.674) =18.784, p<0.001) is showing significantly different at 1% level where the mean post intake has seen to increase drastically. The mean scores of zinc was also showing a significant difference (F(1.284,16.694)=4.521, p=0.041) at 5

Table II. Comparison Between Pre, During, Post Weight Of the Detected Head and Neck Cancer Patients

	Source		Mean±SD	Df	F	P
Greenhouse-Geisser	Weight	Pre	52.51±7.19			
		During	50.06±6.95	1.261	6.692	.015*
		Post	50.53±6.39			
Greehouse-Geisser	BMI	Pre	19.83±2.41			
		During	18.92±2.41	1.261	7.142	0.012*
		Post	19.11±2.39			
Greehouse-Geisser	MUAC	Pre	23.52±2.37			
		During	23.21±2.51	1.288	.505	.533 NS
		Post	23.21±2.13			

weight. However, the mean

**significant at 1% level, *significant at 5% level, NS Non significant

score of Mid-upper arm circumference (MUAC) hardly changed when compared between pre, during and post treatment, hence it is non significant.

% level as well as the intake of Vitamin C was also showing a difference (F(1.432, 18.616)=4.046, p=0.046) at 5% level which may have increased significantly after counseling. However, the pairwise comparison of these nutrients (Table V) has not shown any significant difference. The mean score of Vitamin B2 (F(1.533, 19.92)=7.080, p=.008) is also significant at 1% level as well as the

TableIV Comparison Between Pre, During & Post Treatment Intake

Source		Mean±SD	Df	F	P
Energy	Pre	1491.61±306.49	1.578	4.350	.034*
	During	1397.59±225.91			
	Post	1674.07±327.69			
Protein	Pre	44.45±12.47	1.423	6.839	.011*
	During	43.60±14.30			
	Post	58.87±19.15			
Fat	Pre	46.27±16.05	1.615	2.381	.125^{NS}
	During	37.67±11.52			
	Post	47.51±19.69			
Carbohydrate	Pre	223.98±50.67	1.972	3.176	.059^{NS}
	During	221.01±40.86			
	Post	252.86±44,04			
Calcium	Pre	596.89±221.78			
	During	664.48±352.61	1.667	18.784	P<.001^{**}
	Post	1151.13±565.52			
Zinc	Pre	5.17±1.92	1.284	4.521	.041*
	During	4.84±2.49			
	Post	6.89±3.62			
Iron	Pre	9.17±2.64	1.036	2.878	.112^{NS}
	During	8.04±2.56			
	Post	14.96±13,97			
Vitamin C	Pre	70.04±46.23	1.432	4.046	.046*
	During	62.76±43.76			
	Post	113.21±77.69			
Vitamin A	Pre	376.56±652.44	1.319	5.948	.019*
	During	679±1302.92			
	Post	1482.35±1835.84			
Vitamin B2	Pre	0.95±0.44	1.533	7.080	.008**
	During	1.26±.79			
	Post	1.74±1.05			
Folic Acid	Pre	148.23±57.65	1.253	.963	.362^{NS}
	During	140.84±59.44			
	Post	176.52±92.25			

**significant at 1% level, *significant at 5% level, NS Non significant

pairwise comparison is also showing a significant difference at 1% level when pre intake and post intake was compared.

The intake of Vitamin A has also increased significantly at 5% level from pre to post treatment which was evident from its mean score (F(1.319,17.151)=5.948, p=.019).

Although, the mean scores of iron and folic acid intake is not showing any significance level, their intake has increased non significantly in the post treatment and diet counselling.

The increase in the intake of most of the nutrients were mostly due to the B-Protin nutritional supplement that was prescribed to most of the patients after the treatment has initiated so that they do not experience further loss of their muscle mass.

Table V Pairwise Comparisons of Nutrients Intake Pre, During and Post Treatment

utrients		Mean Difference(I-J)	p-value
Energy			
Pre	During	94.014	.682^{NS}
	Post	-182.464	.421^{NS}
During	Pre	-94.014	.682^{NS}
	Post	-276.479	.028*
Post	Pre	182.464	.421^{NS}
	During	276.479	.028*
Protein			
Pre	During	.851	1.000^{NS}
	Post	-14.419	.039*
During	Pre	-.851	1.000^{NS}
	Post	-15.270	.051^{NS}
Post	Pre	14.419	.039*
	During	15.270	.051^{NS}
Fat			
Pre	During	8.607	.107^{NS}
	Post	-1.240	1.000^{NS}
During	Pre	-8.607	.107^{NS}
	Post	-9.847	.213^{NS}
Post	Pre	1.240	1.000^{NS}
	During	9.847	.213^{NS}
Carbohydrate			
Pre	During	2.971	1.000^{NS}
	Post	-28.881	.210^{NS}
During	Pre	-2.971	1.000^{NS}
	Post	-31.853	13.204^{NS}
Post	Pre	28.881	.210^{NS}
	During	31.853	.094^{NS}
Zinc			
Pre	During	.330	1.000^{NS}
	Post	-1.725	.156^{NS}
During	Pre	-.330	1.000^{NS}
	Post	-2.056	.122^{NS}
Post	Pre	1.725	.156^{NS}
	During	2.056	.122^{NS}
Calcium			
Pre	During	-67.587	1.000^{NS}
	Post	-554.237	.001**
During	Pre	67.587	1.000^{NS}
	Post	-486.650	.002**
Post	Pre	554.237	.001**
	During	486.650	.002**
Iron			
Pre	During	1.130	.295^{NS}
	Post	-5.786	.406^{NS}

During	Pre	-1.130	.295 NS
	Post	-6.915	.295 NS
Post	Pre	5.786	.406 NS
	During	6.915	.295 NS
Vitamin C			
Pre	During	7.276	1.000 NS
	Post	-43.173	.136 NS
During	Pre	-7.276	1.000 NS
	Post	-50.449	.159 NS
Post	Pre	43.173	.136 NS
	During	50.449	.159 NS
Vitamin A			
Pre	During	-302.434	.334 NS
	Post	-1105.791	.045*
During	Pre	302.434	.334 NS
	Post	-803.357	.158 NS
Post	Pre	1105.791	.045*
	During	803.357	.158 NS
Vitamin B2			
Pre	During	-.302	.201 NS
	Post	-.784	.008**
During	Pre	.302	.201 NS
	Post	-.482	.245 NS
Post	Pre	.784	.008**
	During	.482	.245 NS
Folic Acid			
Pre	During	7.395	1.000 NS
	Post	-28.286	1.000 NS
During	Pre	-7.395	1.000 NS
	Post	-35.681	.924 NS
Post	Pre	28.286	1.000 NS
	During	35.681	.924 NS

**significant at 1% level, *significant at 5% level, NS Non significant

Table VI. Evaluation Of The Diet Compliance As Well As Medical Treatment Compliance Of All Detected Head And Neck Cancer Patients

Compliance	Frequency(%)		
	Low	Moderate	High
Dietary Compliance	-	9(64.3)	5(35.7)
Medical Compliance	1(7.1)	-	13(92.9)

The above table shows that majority of the patients i.e. 9(64.3%) out of 14 patients detected with head and neck cancer were moderately compliant to the diet therapy and 5(35.7%) patients were highly compliant to the diet therapy. On the other hand, majority of the patients i.e. 13(92.9%) were highly compliant and only 1(7.1%) patient has shown low compliant to medical treatment i.e. chemoradiotherapy.

Table VII. Relationship Between Dietary Compliance (%) And PGSGA Score

	COMPLIANCE (%)	
	r-value	p-value
Post PGSGA score	-.602	.023*

*significant at 5% level

The diet compliance (%) has been correlated with that of post PGSGA score, where the Pearson's correlation (r) value was showing that they are negatively correlated (r=-.602) with each other and showing significantly different (p=.023) at 5% level. This means that, if diet compliance is high then the PGSGA score will decrease which is an indication of improved nutritional status of the patients.

DISCUSSION

The diet counselling has a positive impact on the nutritional status of the patients as they often experience a drop in their nutritional status as a result of cancer canchexia, anti- cancer treatments like chemotherapy or radiotherapy and the symptoms they develop after treatment. This is quite evident from this study result which showed an increase in weight among the patients non- significantly. The MUAC also remain unchanged post treatment among these patients which is a positive sign as they have not experienced further muscle mass loss which is the most important indicator of protein energy malnutrition among these patients. However, a better result could have obtained in the weight and MUAC with the extended study period as the improvement in these indices takes place gradually and slowly with improved nutritional intake. This result is supported by a study which indicates that the patients who were receiving individual dietary counseling had a maximum of 3% unintended weight loss 2 weeks after the treatment [ ]. However another study indicates that this weight loss cannot be completely prevented by nutritional counseling [ ].

The significant changes have also been noticed in the dietary intake of the patients post dietary counselling. The intake of macro nutrients like energy and protein has significantly increased among these patients post treatment and that reflected on their nutritional status. The result is supported by a research study which proves that there was a significant increase in the caloric and protein intake for the three groups i.e. oral group, naso-enteral tube group & supplement group irrespective of the type of nutritional intervention[ ]. This result is also supported by a study showing that whether the patients were on exclusive oral diet or enteral feeding there was a significant increase in calorie ingestion through supplemented oral diet.[ ] The intake of micronutrients like calcium, zinc, vitamin C, vitamin A, vitamin B2 has also increased significantly after dietary counseling. In addition, the increased nutritional intake also attributed to a nutritional supplement named B-Protin that had been prescribed to most of the patients depending upon their condition and nutritional

status. Certain nutrients like iron and folic acid did show any significant difference in those patients as they get easily depleted due to the anti-cancer treatment. [ ].

Although better results could have obtained with extended study period, the nutritional counseling have played a crucial role on the improvement of the nutritional status of the detected head and neck cancer patients which further helped in the betterment of the overall health condition of the patients.

ACKNOWLEDGEMENTS

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