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Research Article

EFFECT OF SOYA & RED KIDNEY BEAN SUPPLEMENTATION ON NUTRIENT INTAKES OF HEAD AND NECK CANCER PATIENTS

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ABSTRACT
To investigate whether a supplementation with SB, RKB and SB & RKB combination can improve nutritional status of patients with head and neck cancer. A total of 120 head and neck cancer patients were divided into three groups, each group consisting of 40patients, Group A (GA) supplemented with Soy bean (SB), Group B (GB) supplemented with red kidney bean (RKB), Group C (GC) supplemented with Soy and red kidney bean combination. From a total 120 head and neck cancer patients 32 patients were dropped out. For convenience 20 patients in each group were considered for the study. Cases completed all information regarding General Information, Anthropometric Measurements, food frequency, and Nutrient intakes of the cases before and after supplementation were obtained. It was discovered in this study all the patients were nutritionally illiterates. Lack of awareness on their nutritional matter may be the major contributory factor to be noted in the prevalence of Head & Neck cancer. After supplementation anthropometric measurements, nutrient intakes were improved significantly compared to before supplementation in all the Groups (GA, GB & GC). The present study revealed that, SB & RKB, and combination of soy and red kidney bean supplementation has effectively increased nutrient intakes of head and neck cancer patients. The present results indicated that, SB and RKB supplementation had more protective effect compared to SB & RKB alone. However since the lack of other data on this issue, additional research is needed in this area. A large patient cohort with a longer follow up period for therapeutic response studies may yield more significant.

Key Words: *Head And Neck Cancer, Soya Bean, Red Kidney Bean, Food Frequency, Nutrient Intakes*.

INTRODUCTION
Head and neck cancer is the fifth most common cause of cancer death world wide. (Stenson KM. 2010) Head and neck cancers accounts for approximately 6% of all the malignancies in the United States, and over one third of all the cancers in India. (Bhattacharjee A, Chakraborty A, et al., 2006; Mehrotra R, Singh M, et al., 2005) it is the sixth common cause of death in males and the seventh in females. (Bhattacharjee A, Chakraborty A, et al., 2006). Nutrition has been recognized as the second most important factor in predicting long term prognosis in head and neck cancer. (Brookes GB, 1985; Blackburn GL, Copeland T 2003; Stewart BW, Kleihues P 2003). Protein deficiency is common in patients with head and neck cancer and is usually the results of inadequate caloric intake due to local tumor effects, combined with the chronic effects of tobacco and alcohol abuse. The significant influence of nutritional status on therapeutic out comes including surgical morbidity, tolerance of therapy, and overall mortality is well recognized. (Gooduwin WJ, Torres J. 1984; Dewys WD, Begy C,et al., 1980; Hooley R, Levire H, et al. 1983; Brookes GB. 1985).

Soya bean may actually help promote lean body mass gain by the antioxidants associated with soy protein. Antioxidant are agents, either consumed in the diet or made by the body, which work against molecular damage due to oxidant reactions caused by free radicals, which are reactive molecules with an unpaired electrons. (kehrer J. 1993) soy protein isolate contains a mixture of antioxidants including isoflavones, saponins, and copper, a component of a number of antioxidant enzymes. (Disilvestro RA. 2001). Red kidney beans (Phaseolus Vulgaris) are the whole grain consumed in the greatest quality in the world. (Carpenter, K.J.1981). They are an important economical source of protein in the diet of many

developed and developing countries (Nielsen, S.S. 1991). However, Thailand has exported most of the red kidney beans (Tharatthapan, C. 1996). Red kidney beans are rich in B complex vitamins and minerals. (Koeticer, H.H., C. Chang, et al.1987; Guzman-Maldonado, S.H. and O. Paredes-Lopez. 1998) Moreover, red kidney beans are a very low in sodium, cholesterol and saturated fatty acids but rich in unsaturated fatty acids such as linoleic acid. (Barampama Z and R.E. Simard. 1994). They are not only a good source of both soluble and insoluble dietary fiber but also health benefits, including reduced risk of heart disease and colon cancer. (Hughes, J.S. 1991).

Counseling patients with head and neck cancer about SB & RKB requires a systemic thought process that considers the available theories and data, as well as the patient's views on the soy and red kidney beans. Epidemiological studies as well as animal and cell culture experiments therefore provide evidence that suggests that the intake of soy beans lowers the risk of cancer. (Christina S Venter. 1999).

Aims and Objectives of the study:

- To investigate whether a supplementation with SB, RKB & SB + RKB combination can improve nutritional status of patients with head and neck cancer.
- To assess the effect of supplementation on Anthropometric status of patients with head and neck cancer patients.

METHODS AND MATERIALS

For this study 120 head and neck cancer patients with the group ranging from 30 to 60 years of both the sex were taken, where most of the patients were come from rural area and were agricultural laborers and coolies. The selection of sample is based on their willingness to the study. The cases were divided into three groups. GA, GB, GC each group 40 cases.

Figure 1: Preparation of the SB & RKB supplementation

GA supplemented with Soya bean, GB supplemented with red kidney bean, and GC supplemented with Soya and red kidney bean combination. 12 of 40 cases in GA, 11 of 40 in GB, 9 of 40 in GC patients dropped out in the study; in these drop outs 15 cases had died. Discontinued participation in the study for various reasons, such as distaste for food, nausea, early satiety, inability to cook, &/or embarrassment regarding carrying the supplementation to home. The other 28 cases in GA, 29 cases in GB, 31 cases in GC, cases all completed the study. For equal number 20 cases selected for analysis who followed sincerely in entire the study.

Table 1: Nutritive value of Soya bean, Kidney Bean and Combination Supplementation Diet:

Energy	Protein	CHO	Fat	Fiber	Calcium	Iron	β carotene	Thiamin	Riboflavin	Niacin	Folic Acid	Vitamin C	Zinc
(k.cal)	(gms)	(gms)	(gms)	(gm)	(mg)	(mg)	(IU)	(mg)	(mg)	(mg)	(ug)	(mg)	(mg)
2168	75.88	255.27	66.95	12.43	1079.5	19.58	7942.3	2.078	2.34	10.1	414.96	180.6	15.38
2065.3	68.59	275.11	53.94	15.36	984.1	14.01	7686.8	2.37	1.01	8.29	336.26	172.7	11.025
2471.8	82.54	317.5	61.41	12.75	999.4	17.57	7321.1	2.01	2.4	10.74	403.82	138.8	13.43

Soya and Red kidney bean recipe (liquid form) intervention study was performed. The recipe had to be taken in addition to the balanced high protein soft diet consumed, two times a day for four months on selected head and neck cancer patients. The supplementation was prepared by using Soya and Red kidney bean separately and Soya and red kidney bean combination (fig.1) in addition to that jaggery and dehydrated carrot powder was added. 90% of the cases had hospital high protein diet was taken. Hospital diet includes rice, vegetable and green vegetable curry, two eggs, sambar, butter milk and two bananas will be supplying for the patients two times a day along with morning breakfast. The nutritive values of the sample menu along with the supplementation are given below in Table I. The supplementation contained semi liquid, sweetener and for flavoring illaichi were added. Patients received the supplementation in the morning one glass (250ml) and evening one glass (250ml), the investigator used to visit the hospital every day.

Questionnaire:

Cases completed all information regarding General Information, Anthropometric Measurements, food frequency, and Nutrient intakes of the cases before and after supplementation were obtained.

Nutritional Assessment:

At the first three days a history was taken, and physical examination was performed. The study investigator obtained a 24h recall diet history (Bomji MS, Rao NP, 1999) was assessed by specific food frequency questionnaire. Standardized big and small steel katories a set of tea and tablespoons generally used in the nutrition laboratory were distributed to the cases to collect data on quantities cooked food intakes the cases. The nutritive values of the cooked diets were calculated using the raw weight of the ingredients from which the recipe was prepared from this the nutritive value is back calculated for the cooked foods. Thus the nutrient intakes of the individuals were obtained.

Physical exam:

Height (to the nearest centimeter), weight (to the nearest 0.1kg) were measured in light clothing without shoes. Body mass index (BMI) was calculated in all cases before and after supplementation.

RESULTS AND DISCUSSION

General Information:

Table II shows the number with percentages of cases General Information 120 Head & Neck Cancer patients were divided into three groups. GA 40 (33.3%), GB 40 (33.3%), & GC 40 (n-33.3%). In GA total of 40 number 29 (72.5%) male & 11 (27.5%) female cases. In GB total of 40 number 25 (62.5%) males & 15 (37.5%) female cases. In GC total of 40 number 22 (55%) male and 18 (45%) female cases. In total of 120 patients 76 (63.333) males & 44 (36.666%) were female cases. In the developing countries like India the incidence and prevalence of head and neck malignancies is very high with common male: female ratio of 3:1. (Gupta PC, Nandakumar A, 1999). Total 120 head and neck cancer cases 103 (85.83) cases were illiterates and 17 (14.16) cases were $<10^{th}$. Total 120 head and neck cancer patients 108 (90%)

were cooli, 10 (8.33%) were business. Total 120 head and neck cancer patients 115(95.833%) were low income & 5 (4.166) were middle income. From total 120 head and neck cancer patient 53 (44.166%) were in joint family, 67 (55.83%) cases were in nuclear family. From total 120 head and neck cancer patient 108 (90%) were heavy workers, 12 (10%) cases were in moderate workers. From total 120 head and neck cancer patient 118 (98.33%) were non veterinarians, 2 (1.6%) cases were veterinarians.

It was discovered in this study all the patients were nutritionally illiterates. Lack of awareness on their nutritional matter may be the major contributory factor to be noted in the prevalence of Head & Neck cancer, inspite of living in the pollution free rural areas with abundantly gown & available low cost high nutritious fruits and vegetables etc... at low and affordable cost. Hence low income may not be a major contributory factor.

Table 2: General Information of the Head and Neck cancer patients:

Variable	**Group A 40n-33.33%)**		**Group B 40n-33.33%)**		**Group C 40n-33.33%)**	
	Male29 72.50%	**Female-11** 29.50%	**Male-25**	**female 15**	**Male-22**	**Female 28**
Education:						
Illiterates	25(86.2)	9(81.81)	23(92)	11(73.73)	21(95.45)	14(77.77)
>10th	4913.7)	2(18.18)	2(8)	4(26.66)	1(4.54)	4(22.22)
UG	0	0	0	0	0	0
Occupation:						
Cooli	27(93.10)	8(72.72)	22(88)	14(93.33)	20(90.90)	17(94.44)
Business	1(3.44)	3(27.27)	3(12)	1(6.66)	1(4.54)	1(5.55)
Driver	1(3.44)	0	0	0	1(4.54)	0
Socioeconomic Status:						
Low Income	29(100)	10(90.90)	24(96)	15(100)	21(95.45)	16(88.88)
Middle Income	0	1(9.09)	1(4)	0	1(4.54)	2(11.11)
High Income	0	0	0	0	0	0
Type Of Family:						
Joint	15(51.72)		8(32)	8(53.33)	6(27.27)	12(66.66)
Nuclear	14(48.29)		17(68)	7(46.66)	16(72.72)	6(33.33)
Type Of Activity						
Heavy Work	27(93.10)	8(72.72)	24(96)	11(73.33)	21(95.45)	17(94.44)
Moderate Work	2(6.89)	3(27.27)	1(4)	4(26.66)	1(4.54)	1(5.55)
Light Work	0	0	0	0	0	0
Type Of Diet:						
Vegetarians	0	1(9.09)	0	0	1(4.54)	0
Non-Vegetarians	29(100)	10(90.90)	25(100)	15(100)	21(95.45)	18(100)

Easy availability of these products and advertisements in the print media and T.V has adversely affected the younger generation leading to more consumption of these carcinogens. (B.S Tuli, K.K. Gupta, etal 2003) Health education and general awareness by the doctors, non-government organizations and other social organizations are of great importance for education people on the illiterates of tobacco, alcohol and other carcinogens. In the gender distribution male cases were far more common than female cases. The male predominance is due to the fact that males are more exposed to habit of smoking and tobacco chewing, panparag, gutka and of their increased awareness and accessibility to health service. (Abhinandan Bhattacharjee, A. Chakkraborthy, et al., 2006).

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Anthropometric Measurements:

Table III shows the basic anthropometric measurements of cases before and after supplementation. Heights and weights are the important measurements to know the health, and Nutritional status of the individuals. The body weight was recorded at baseline and at each week of treatment. There is no significant difference between cases height before and after supplementation. There is a significant difference between cases (GA, GB, and GC) before and after supplementation at 0.05 level of significance. Hence there has been an increase in the weight and BMI of the experimental group but not to the fullest extent and the cases was able to sustain their life better than the before supplementation. Preventing weight loss, therefore, could potentially have multiple benefits in terms of reducing mortality, economic stability, contributing to increased productivity and perhaps improving responses to treatment.

Table 3: Anthropometric measurements of male and female cases (GA, GB & GC)before and after supplementation:

		Group A			Group B			Group C		
		Height(cms)	Weight(kgs)	BMI	height(cms)	Weight(kgs)	BMI	height(cms)	Weight(kgs)	BMI
Male	Before	164.55±5.71	48.9±10.5	18.67±3.52	166.10±6.24	50.35±5.91	18.39±1.71	163.80±6.25	50.30±6.47	18.42±1.63
	after	164.55±5.71	55.75±6.98	20.99±2.06	166.10±6.24	57.05±4.41	20.87±1.28	163.80±6.25	54.93±4.36	20.24±1.80
tab v cal		0.00	2.44	2.54	0.00	4.06	5.18	0.00	2.67	3.35
female	Before	154.20±3.89	45.57±5.17	18.87±1.89	153.90±3.96	46.15±4.33	19.33±1.60	153.20±4.29	42.29±8.82	18.19±3.60
	after	154.20±3.89	52.00±4.60	21.47±1.94	153.90±3.96	50.90±4.95	21.74±2.55	153.20±4.29	48.85±5.85	21.66±2.89
tab v cal		0.00	4.16	4.28	0.00	3.23	3.6	0.00	2.77	3.36

Food frequency and Nutrient Intakes:

Table no 4 & 5 shows the mean food frequency and nutrient intakes of cases before and after supplementation.

It was discovered in this study the intakes of cereals, and animal foods particularly red meat consumption were high. Red meat includes all fresh, minced and frozen beef, pork and lamb. Gotay C C (2005) and WCRF/AICR (2007) have generally agreed that consumption of a diet rich in vegetables, fruits, and other plant food constituents; low in animal fats, along with maintaining a physically active healthy weight can reduce the risk of cancer and other chronic diseases. Fresh fruits and vegetables are rich sources of antioxidant vitamins like A, C and E that prevents cellular damage associated with cancer incidence. The scavenging capacity of the antioxidant vitamins prevents oxidative damage by neutralizing the free radicals. Environmental carcinogens cause 50 to 90% of all cancers. The remaining 10% of cancers are caused by several other factors, not all of which are understood (World Cancer Research Fund Report.2007 & IARC Handbooks on Cancer Prevention (2003) They found "the evidence for a protective effect of greater vegetable and fruit consumption is consistent for cancers of the stomach, esophagus, lung, oral cavity and pharynx, endometrium, pancreas, and colon." Vegetables, and particularly raw

vegetables, were found to be protective; 85% of the studies that queried raw vegetable consumption found a protective effect.

Table 4: Food frequency of cases (GA, GB & GC) Before and After Supplementation:

	Group A			Group B			Group C		
	Before	After	tab v cal	Before	After	tab v cal	Before	After	tab v cal
Cereals	270.0±33.0	230.0±25.8	3.02	287.0±18.9	2310±26.9	5.39	279.0±32.8	231.0±25.1	3.67
Pulses	30.50±9.85	61.40±5.83	8.54	25.0±10.8	59.50±6.43	8.68	29.5±15.0	61.00±6.15	6.15
leafy vegetables	38.5±25.4	72.0±28.5	2.78	28.0±22.0	65.0±21.1	3.84	21.57±16.0	57.0±15.7	5.01
Other vegetables	44.00±9.66	77.5±24.9	3.97	43.00±9.49	77.5±24.9	4.10	38.0±13.2	82.57±23.7	5.19
Roots & Tubers	30.0±14.9	72.5±21.9	5.07	37.5±15.1	65.0±21.6	3.30	37.5±12.7	66.0±20.5	3.73
fruits	47.5±38.1	140.0±51.6	4.56	46.0±11.7	90.0±21.1	5.77	39.0±21.8	120.0±42.2	5.39
milk	52.0±36.7	185.0±81.8	4.69	65.0±21.1	165.0±66.9	4.51	50.5±23.6	190.0±65.8	6.31
Animal foods	75.0±47.1	7.0±16.4	4.31	85.0±41.2	8.0±16.2	5.50	90.0±69.9	7.5±16.9	3.63

After supplementation cases nutrient (energy, protein, fat, calcium, Iron, β carotene, Thiamin, Riboflavin, niacin, folic acid, vitamin C & Zinc) intakes were significantly increased compared to before supplementation. Energy intakes of GB were similar among before and after supplementation. Kidney beans can help balance blood sugar levels while providing steady, slow-burning energy. Moreover recent studies have documented that diets and energy balance influence carcinogenesis in genetically altered animals like p53- deficient mice.(Hursting SD, Lavigne JA et al, 2004; Patel AC, Nurez NP et al.2004). In GC cases energy consumption were more beneficial compared to GA & GB. Combination of plant proteins like cereals and pulses can provide proteins of equally good quality. Soya products have been associated with a beneficial effect on cancer patients. Tissue protein synthesis, a necessary component of healing and rehabilitation, requires essential amino acids and nitrogen. Effective protein use, which depends on an optimal protein/calorie ratio, promotes tissues building, prevents tissue wastage (catabolism) and helps make up tissue deficits. In the present study Soya supplemental group protein intakes were high than the kidney beans and Soya and red kidney bean combination.

Energy and protein needs depends on the extent of surgery and other therapies, the stage of the disease, body weight, age, gender, activity level and nutritional status. In general, 25 to 30 kilocalories/kg body weight per day and 1 to 1.5gms of protein per kg per day is appropriate for those of normal weight. For those who are hyper metabolic or need to gain weight, 30 to 35 kilocalories per kg or greater and 1.5 to 2.5 g of protein per kg may be necessary. (Roberts S, Mattox T. 2007). In the present study the investigator use a range of 20 to 30 kilocalories/kg, in some cases the investigator found the need for weight gain in head and neck cancer patients to be as high as 39kilocalories/kg. Calories are increased in situations at undesired weight loss, lack of weight gain when needed, poor wound healing, increased activity levels, or subjective fatigue or hunger.

Before supplementation cases consumption of carbohydrate rich foods including rice were more & intake of fruits and vegetables were low. It was discovered in this study legumes including SB, RKB alone and combination contain complex carbohydrates, vegetable protein, dietary fiber, oligosaccharides, phytochemicals (especially the isoflavones in soya) and minerals. The importance of oligosaccharides as prebiotics and their role in colon function is being widely recognized. (Gibson GR, Rober froid MS, 1995). The isoflavones genistein and daidzein are unique to soya beans and have numerous biologic functions. (Adlercreutz CHT, Goldin BR et al.1995)

Table 5: Mean Nutritive values of cases (GA, GB & GC) before and after supplementation

		Group A	**Group B**	**Group C**
Energy	Before	1830±267	1784±166	1720±238
	after	2114±490	1842±210	1975±165
tab v cal		2.27	0.97	3.94
Protein	Before	41.0±11.7	40.45±9.44	35.59±7.23
	after	89.7±21.0	65.8±20.4	64.4±15.9
tab v cal		9.08	3.86	7.35
CHO	Before	278.5±28.1	288.8±37.2	271.3±41.3
	after	292.7±34.6	294.0±40.0	291.2±34.4
tab v cal		1.49	0.42	1.16
Fat	Before	41.86±6.38	42.54±6.10	40.48±8.23
	after	60.90±5.84	50.33±5.82	47.93±9.00
tab v cal		9.84	4.13	2.73
Calcium	Before	410±159	386±118	381±114
	after	917±301	689±136	782±115
tab v cal		6.67	7.52	11.1
Iron	Before	6.52±1.98	5.83±2.36	5.44±2.22
	after	9.50±5.92	22.57±8.57	15.2±10.3
tab v cal		2.14	8.72	4.18
β carotene	Before	567±678	616±650	493±829
	after	3274±1532	2890±2850	3315±1876
tab v cal		7.22	3.45	6.16
B1	Before	1.39±1.31	1.18±0.98	0.65±0.87
	after	2.34±1.38	1.42±1.38	2.10±1.09
tab v cal		2.24	0.6	4.62
B2	Before	0.805±0.55	0.60±0.63	0.590±0.47
	after	1.71±0.61	1.145±0.7	1.48±0.76
tab v cal		4.92	2.55	4.45
Niacin	Before	7.66±2.27	6.11±2.85	7.27±2.00
	after	10.70±2.45	8.95±2.89	8.12±2.18
tab v cal		4.07	3.15	1.28
Folic Acid	Before	99.6±60.5	100.6±56.6	89.9±34.2
	after	385±118	205.4±90.3	259.6±94.0
tab v cal		9.59	4.4	7.58
Vit.C	Before	22.47±8.09	26.5±12.2	22.29±8.20
	after	77.0±28.8	74.2±27.4	65.2±22.9
tab v cal		8.16	7.13	7.9
Zinc	Before	5.24±0.977	4.71±0.6	4.85±2.62
	after	7.89±1.51	5.00±1.38	16.9±11.8
tab v cal		6.57	0.84	4.45

Thiamin participates in enzymatic reactions central to energy production and is also critical for brain cell/cognitive function. If kidney beans a staple in regular healthy diet: a one cup serving of cooked kidney beans provides 18.7% of the daily value for B1.

Impaired Zinc status was identified in 63% of malnourished patients and also in 70% of patients with normal nutrition. These observations indicate that impaired zinc status can exist independent of protein deficiency in the head and neck cancer patients and further support the use of cellular zinc criteria for evaluating zinc status. Zinc is necessary for the antioxidant enzyme called zinc SOD (Zn SOD).

Soya beans are rich source of calcium, magnesium, like mineral components and all types of B complex vitamins and rich in vitamin A & E. Vitamin A exists as provitamin β carotene. Tocopherols are an important constituent of Soya oil to the vitamin E supplied for human nutrition and the antioxidant properties of tocopherols that protect the oil. (Anaheim, CA, 2011)

The investigator found an inverse association between intake of carotene, vitamin C, Vitamin E, vegetables and fruits and HNSCC risk. Regarding macronutrients, namely protein, carbohydrate intake, before supplementation no difference was seen in cases.

Before supplementation the mean nutrient intakes of protein, iron, β carotene, calcium, Vitamin C and B complex vitamin were much below the RDA. This could be due to the low consumption of foods like cereals, pulses, green leafy vegetables, roots and tubers and fruits and the patients have problem in swallowing itself. Which reflected in a lower intake of above mentioned foods. Soya, red kidney bean alone and combination supplementation provides good amount of protein, energy, complex carbohydrates and calcium is meeting the day's requirement. This supplementation also contain good amount of β carotene, this is because of the addition of carrot powder.

CONCLUSION

It was discovered in this study evidenced, Soya bean and red kidney bean supplementation to head and neck cancer patients undergoing treatment had a beneficial effect by improving the nutrient intakes and anthropometric status of the cases. Combination of Soya and red kidney bean improves the nutrient values of patients. Supplementation during Treatment may serve as an adjuvant therapy in head and neck cancer patients offering a good protection to normal cells that may further reduce the risk of developing secondary cancers. To our knowledge, this is the first study to examine the effects of both Soya and red kidney beans on nutritive values of head and neck cancer patients. However since the lack of other data on this issue, additional research is needed in this area.

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