Epidemiological Aspects and Supplementation Studies of Selected Cancer Patients

BY

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CHAPTER - I

INTRODUCTION

World over, today cancer is increasingly recognised as an important public health problem. The latest global statistics on cancer released by the World Health Organization (WHO) show that in absolute numbers there are now more cases and deaths from cancer in the third world than in the industrial countries (Parkin et al, 1984).

'Cancer' is a term that is used to describe a wide variety of malignant diseases, the management of which requires several medical disciplines (Mc Leod 1987). It must be said to the everlasting credit of the famous Greek physician Hippocrates that he recognised the true nature of the disease and termed it 'Karkinoma', the Greek world for crab; something which grows haphazardly, throwing out projections like the legs of a crab (Khurana, 1980). Cancer has been proved almost without exeception to contain cells from only one family. However, even though cancers are in the sense 'Clonal', a considerable amount of modifaction by variation and natural selection can occur during the growth of each cancer (Doll and Peto,1981). Cancer is a major challenge in our century. Today 20 percent of deaths in America and Europe are due to cancer. They are expected to go up to 50 percent by the year 2000 A.D. In India, cancer is the sixth leading cause of death. The other under developed countries of the world are not far behind (Kulkarni,1980).

Throughout the Western world the commonest sites of malignant disease are lung, large bowel and breast. In many developing countries, the incidence of cancer is alarmingly but steadily rising (Mc Leod, 1987). Carcinoma of the cervix is the most frequent of all the genital tract cancers and, of all cancers occuring in women, it takes second place after cancer of the breast. In India, the incidence of cervical cancer has been increasing at an alarming rate. India alone accounts for 10 percent of the global load of cancer of cervix cases and 20 percent of the load of developing countries (Luthra,1989).

Epidemiologists suggests a wide acceptance that most cancers in man are caused by environmental factors has brought much attention to the role of tobacco, smoke and modern industry in the etiology of cancer in Western Countries (Schoental, et al, 1981; Milder, et al 1980, 1981). So many factors in the environment are potential causes of cancer. They include substances in the air we breathe, the water we drink, the regions in which we work and live and the food we eat (Wynder, 1981).

In a recent survey of the trend in mortality from cancer in the United States of America (USA), it has been estimated that upto 90 percent of all such deaths could be attributed to potentially avoidable factors, namely tobacco, alcohol, diet, reproductive and sexual behaviour, occupation, pollution and geographical factors (Mc Leod, 1987).

Research on the role of diet in the causation of cancer in man has undoubtedly been influenced by appreciation of the great variety of mechanisms by which the diet may affect carcinogenesis

in experimental animals (Schoental, et al, 1981). It is conceivable that some foods and nutrients help the body fight cancer and prevent recurrence. Purified fish oil supplements taken before and after cancer surgery may prevent spread of cancer cells that may escape in the operation (Willet, 1987).

Protection against a variety of chemical carcinogens has been afforded by various indoles (found largely in Brassicacease family including brusselsprouts, cabbage and broccoli) high fibre diets (used mainly for the dietary therapy of colo-rectal cancer) and other inducers of microsomal enzymes, including, polycyclic hydrocarbons (which are toxic), flavones, barbiturates and phenothiazines (Boutewell, 1983). A number of studies have proved the beneficial or harmful effects of selenium, cadmium, molybdenum, arsenic, lead, zinc, eicosapentaenoic acid, vitamins A, B, C, B_{12} and Eicosa Hexaenoic acid (Karmali, 1987).

Can dietary regimen defeat cancer? This is a question that has been answered positively by some scientists, but negatively, by others. Once the type and nature of cancer, its etiological factors and associated symptoms and, or diseases have been diagnosed, the next step is the implementation of a suitable therapeutic measure (New York Times, 1989).

Many of the popular dietary regiments are nutritionally unbalanced and may deprive patients of essential nutrients needed to battle, diseases, like cancer that may interfere with appetite and absorption of foods. The high bulk macrobiotic diet, for example may provide inadequate amounts of calories, protein, riboflavin, vita-

min D, pyridoxine, cyanocobalamine and niacin, calcium, iron and zinc and excessive amounts of sodium and refined sugar (New York Times, 1989).

Proponents of questionable dietary treatments often describe them as harmless stimulants of the body's natural ability to conquer cancer, in contrast to the immune - suppressing side effects of many established treatments which are supposed to restore metabolic balance, detoxify the patient and defeat the cancer the natural way. A prudent diet for a cancer patient should contain ample amounts of vegetable and fruits, especially vegetables of the cabbage family, reasonable amounts of fibre-rich grains and low fat sources of proteins (New York Times, 1989).

Though some ground has been broken in the area of cancer research, there still exists paucity of information on several aspects especially those related to epidemiological, dietary and nutritional factors. Hence, the investigator planned the present study, namely 'Epidemiological Aspects and Supplementation Studies of Selected Cancer Patients', with the specific object of investigating the types and incidence of cancer in and around Coimbatore city, it aimed at associating the various etiological factors including life-styles, cultural and religious practices, socio-economic and literacy status, and dietary patterns and nutritional status on the incidence of cancer. It also aimed at supplementation of a high-protien, defatted, deodorised soya flour in the diets of selected cancer patients over a period of three months.

Review of Literature

CHAPTER - II

REVIEW OF LITERATURE

Review of literature pertaining to this investigation is discussed under the following headings :

A. Pathology of Cancer

B. Incidence of Cancer

C. Etiological factors in carcinoma

D. Relationship between nutrients and cancer

E. Relationship of diet to cancer at specific sites

F. Role of soyabean as a novel protein.

A. Pathology of Cancer :

A "tumor" is a new formation of cells of independent growth which fulfils no usual function. "Metaplasia" is defined as the epithelium from which the tumor grows, that has already changed its characteristics, eg., bladder transitional epithelium to squamous epithelium (Hading, et al, 1988).

Cancers are classified into three major groups namely, (1) The Carcinomas which arise in endodermal or ectodermal tissue, (2) The sarcomas of mesodermal origin, and (3) The leukaemias and lymphomas which are derived from the white blood cells and the monocyte-macrophge system (Mc Leod, 1987).

Carcinoma of the uterus is regionally divided into : (1) Carcinoma of the endometrium of the body of the uterus and (2) Carcinoma of the cervix. This again can be subdivided as : (a) Carcinoma of

the portio vaginalis, comprising 80 percent of all cervical cancers; and (b) Endocervical carcinoma, which accounts for the remaining 20 percent.

The stages of cervical carcinoma are :

Stage I : Ulcerating, Infiltrating, or Cauliflower type

Stage II : Infiltration of the Vagina

Stage III: Infiltration of the parametrium together with the whole of the vagina

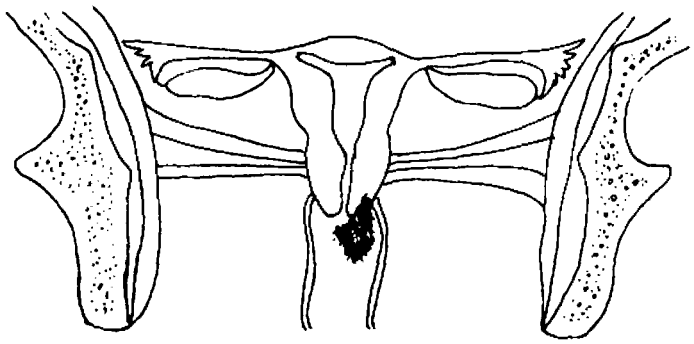
Stage IV : Infiltration into the rectum and bladder, together with bone metastases.

The diagrams of the stages of cervical cancer are presented in Figure 1.

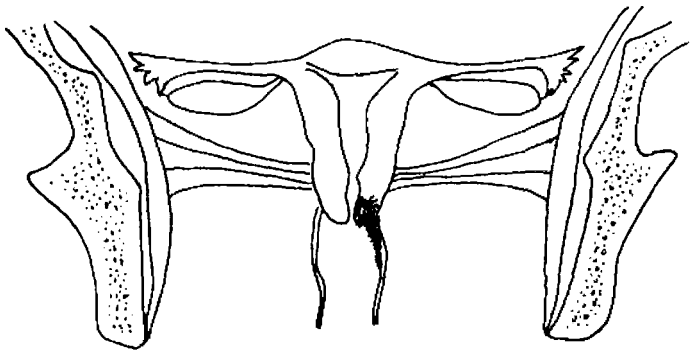
Cancer of the cervix is characterised by physical signs namely cachexia, profuse vaginal bleeding, loss of mobility and induration. The patients are anaemic and show signs and symptoms of incipient uraemia, with loss of appetite headache and sickness. Weight loss is obvious and sometimes extreme (Hawkins, 1988). Studies have shown that incidence of HPV (Human Papilloma Virus) infection is responsible for the high incidence of cancer of cervix and there are also preliminary indications that a new Indian strain of HPV might be responsible for cancer of the cervix, a disease that affects a lakh new women every year. Another significant finding is the link between HPV infection and cervical erosion (Luthra, 1989).

1. Formation and Action of Carcinogens :

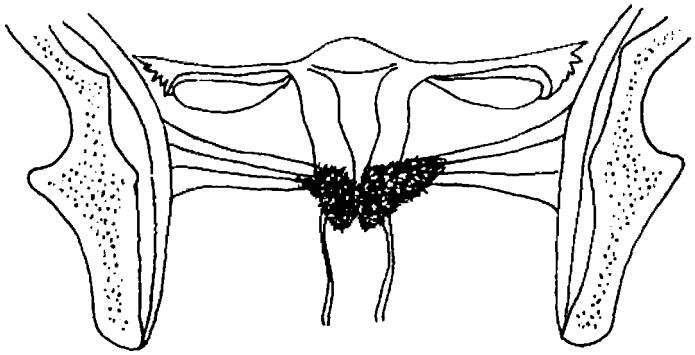
Carcinogenic agents develop in the environment in many ways - through ionizing radiation, in industrial chemical processes and their



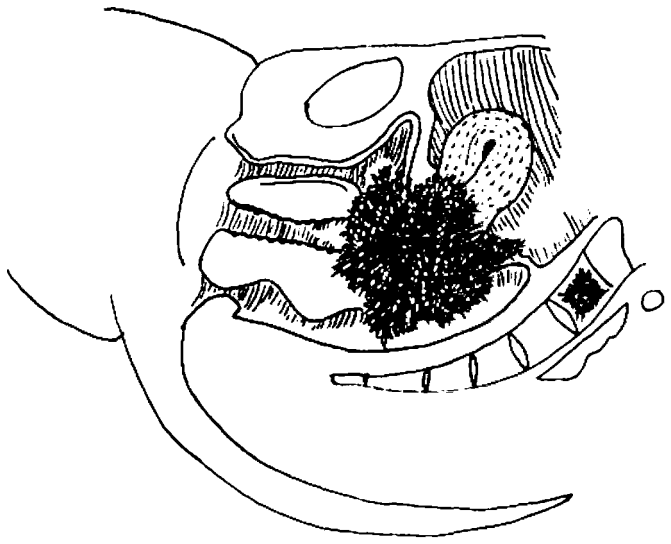
STAGE I. CAULIFLOWER TYPE



STAGE II. INFILTRATION OF THE VAGINA



STAGE III. INFILTRATION OF THE PARAMETRIUM



STAGE IV. INFILTRATION OF THE RECTUM AND BLADDER

STAGES OF CERVICAL CARCINOMA

FIGURE - 1.

the products and effluents, in certain chemicals added to food of present as contaminants, as natural toxicants, and as products of microbial action in the intestine.

The two main stages of carcinogenesis are :

(1) Initiation : An early and irreversible stage, produced by a single or very limited application of a carcinogen.

(2) Promotion : Is the stimulation of development from an initiated cell to a tumor.

A complete carcinogen performs both functions. Some dietary modifications have been shown to be capable of altering each of these stages of tumor development (Poierier, 1987). Certain dietary constituents-nutrients and non-nutrients (Anutrients) - inhibit carcinogenesis. The classification of Wattenberg (1983) is based on the time in the carcinogenic process during which the inhibitors are effective.

The categories are :

(1) Compounds that prevent the formation of carcinogens from precursors (ascorbic acid and tocopherol have this type of action, as well as other actions);

(2) Compounds that prevent carcinogenic substances from reaching or reacting with critical target sites in the tissue, ie., "Blocking agents";

(3) Compounds that act by supressing the expression of neoplasia in cells previously exposed to doses of carcinogens that ordinarily would result in cancer, ie., "Supressive agents". Some inhibitors are capable of acting at one or more times.

2. Nutritional Effects of Cancer Therapy :

Obstruction by a tumor may interfere with nutritional intake or digestive or absorptive functions. Nutritional status may be further compromised by surgery, radiation, chemotherapy, or immunotherapy. Lawrence, (1977) opined that interference of chewing and swallowing mechanisms follow surgery of head and neck regions; impaired absorption of nutrients, especially of fat, following gastrointestinal surgery; and diabetes mellitus may occur secondary to pancratectomy.

The nutritional problems associated with radiation therapy depend on the site and dose of irradiation. Adverse effects of irradiation to the upper alimentary tract include "Xerostomia" (dry mouth) due to impaired salivary secretion, dental caries, loss of teeth, altered taste sensation, loss of appetite, dysphagia, sore mouth and throat, and oesophageal irritation (Holland, 1977).

Driever, (1979) stated that virtually all chemotherapeutic agents cause nausea and vomiting, reduced food intake, generalised weakness, fluid and electrolyte imbalance, weight loss, mucositis, glossitis, cheilosis, esophagitis, constipation or diarrhoea, malabsorption syndromes, and vitaman deficiencies occur with some drugs. Immune therapy may induce a flulike syndrome, with chills, fever, malaise, nausea and body aches.

B. Incidence of Cancer :

It has been suggested that atleast 80 per cent of cancer cases can be related to environmental factors rather than to genetic differences (Higginson, 1970; Doll, 1981).

1. World Wide Incidence :

In general, incidence date are used when available, since they more directly relate to etiology, being uninfluenced by changes in survival due to advances in the management and treatment of cancer. (Doll et al, 1981). Analysis from, WHO Cronicle (1985) showed an overall increase of death rates from cancer by 55 per cent in men and 40 per cent in women from 1960 to 1985. The most dramatic rise in age-adjusted moratality was registered for lung cancer, 76 per cent for men and 135 per cent for women. Lung cancer is currently the second most common cancer, worldwide and could soon become the most common (Parkin, et al, 1986).

A major problem in South East Asia is oral cancer, with more than a hundred throusand new cases each year (WHO Bulletin, 1984). Cancer of the uterine cervix is the most common in developing countries and is the second most common cancer world wide in women, with approximately half a million new cases each year. Decreases of 50 - 60 percent in cervical cancer nortality have been observed in countries where cytological screening has been undertaken in well organised fashion.

Patterns of malignant disease vary greatly between different communities. Some tumors are rare, for example, carcinoma of the colon or lung in Asia and Africa and in the Singapore Chinese. Carcinoma of the mouth is the commonest cancer in India and Sri Lanka and Carcinoma of the nasopharynx associated with the Epstein Bare virus is frequent in Kenya and among Chinese in South East Asia (Mc Leod, 1987).

In Italy, sale of cigarettes increased rapidly between 1920 and 1940 and currently it is observed that the death rates from lung cancer in males aged 45-54 are among the highest in developed countries. Since 1986, lung cancer rates in males increased by 162 per cent in Yugoslavia, 129 per cent in Poland and 100 per cent in Hungary. In the USSR lung cancer death rates increased by 55 per cent between 1970 and 1980. In contrast the rate for males aged 45 and 54 has fallen since 1968 by 49 per cent in Scotland, 40 per cent in England and 35 per cent in Northern Ireland, although the U.K. still has one of the highest rates in the world (Mc Leod, 1987).

2. Incidence in India :

Jussawalla (1989) states that one out of the eight Indians gets cancer and that the chances of getting cancer is rather high, among Indians. Though the disease can occur at any age, the incidence is higher in the over-50 age group.

The incidence of cancer among women in Bombay during the year 1987-88 was topped by cervical cancer (26 per cent) followed closely by breast cancer (18 per cent), and leukaemia (5 per cent), and oral cancer (5 per cent). Among men the incidence in descending order is cancers of pharynx and larynx (16 per cent), oral cancer (12 per cent), stomach cancer (9 per cent), and lung cancer (9 per cent) (Krishnaswamy, 1988).

From the annual report of cancer registry of Bangalore, the incidence rates for cancers at all sites were for men 63 per 100,000 (crude) and 115.1 per 100,000 (age-standardised) and for

women, 85 per 100,000 (crude) and 15.1 per 100,000 (age standarised). In men, the dominant tumors were those of oral, and stomach. In females, cervical cancer is more dominant, with a high relative frequence and incidence rate, especially among Hindu women. Carcinoma of penis was common in Bangalore (2.8 per cent) and the incidence of breast cancer was only half that of cervical cancer, among women. (Bhargava and Kumar, 1987).

In Madras, the rates for cancer at all sites were for males 54.9 per 100,000 (crude) and 86.4 per 100,000 (age adjusted) and for women 81.4 (crude) and 118 per 100,000 (age adjusted) (Shantha, et al, 1988).

High frequence of lung cancer (11.8 per cent, crude) when compared with other Indian registries was observed at the Post Graduate Institute of Medical Education and Research, Chandigarh (Gupta, and Grova, 1988).

The Dibrugarh Registry, at the Assam Medical College recorded more female cases than males, that is, 86 per cent and 74 per cent respectively. North-East India represents, one of the highest risk areas in the world, as very high frequency of oral and pharyngeal cancers in both male and female were seen, especially of the tongue. This was attributed to the consumption of arecanut or tamol (Anand and Goswami, 1956; Zaman, et al, 1988).

The Regional Cancer Centre at Trivandrum reported that in females, cancer of mouth, tongue and oropharyx were responsible for 27.2 per cent of cancer; and these sites accounted for 14.8 per

cent of tumors in females, cervical cancer (25.6 per cent) and breast cancer (17.1 per cent) (Nair, et al, 1988).

C. Etiological Factors in Carcinoma :

1. Age

Age has a bearing on the incidence of specific cancers. In children, cancer is the leading cause of death between the ages of 3-13 years, about half of these being due to acute lymphoblastic leukaemia. Men are at a greater risk than women between the ages of 60 to 80 (Mc Leod, 1987). A factor analysis of mortality from gastric cancer in the populations of 41 countries revealed the inter-relation between age and cancer; this interrelationship has both a biological and a chromological component. On one hand, tumor development is linked to the molecular-genetic and systemic-physiological mechanisms of ageing. On the other hand, increasing mortality from cancer with age reflects the number of years for which the organism was exposed to the carcinogenic action (Voitenko, et al; 1985).

2. Sex

Studies by Ochsner, (1974) led to the belief that women smokers are less likely, than men to develop lung cancer, possibly because the bronchial mucosa in women is less susceptible to malignant change than in men. The study of the incidence of cancer among Indians, has shown a definite increase in the per cent of women affected mainly by breast and cervical cancers and to a small extent by oral cancer (Luthra, 1989).

3. Body Weight :

A positive association has been determined between body size (and weight) throughout life and breast cancer risk. The role macronutrient intake during early life can be indirectly studied, however, by examining past and present body size. A study by Marchard, et al (1988) provided evidence on the protective role of adolescent obesity against premenopausal breast cancer and for an enhancing role of a positve energy balance during adult life on post menopausal breast cancer.

4. Heredity :

Heredity is one of the factors implicated in individual differences in predisposition to cancer. Genetic effects are largely dependent by age : tumors in young subjects are most dependent on heredity (Voitenko, et al, 1985).

5. Stress :

Stress certainly can increase the risk for cancer if it causes individuals to smoke more cigarettes or if it prevents the individual from kicking the habit or increasing his exposure to any other factor though to cause cancer, though scientific studies so far undertaken have not been able to link stress directly with cancer. Some researchers however feel that there are two stress factors that increase the chances of cancerous growth. One is brain activity that depresses the immune system, thereby decreasing the body's innate ability to fight cancer. The other is, brain activity that creates hormonal imbalance but more development in this area is required before any definite claim can be made (Wynder, 1981).

6. Association with Socio Economic Status :

By and large, cancer is a disease of the affluent society, due to obvious reasons namely high clorie, high fat, non-vegetarian diets, smoking and drinking. The poor in India get cancer of the mouth because a wad of uncured tobacco is kept in the mouth, next to the cheek, as a cheap substitute for expensive cigarettes. Women of the lower socio economic status get cervical cancer more often than rich women because of lack of proper hygiene and sanitation. Poor people in Kashmir are susceptible to Kangri cancer because that is the only means that they have of keeping warm in the freezing Himalayan climate. This leads to a localised skin cancer. Poor workers in mines, tanneries and plastic factories, asphalt and coal tar workers are affected by cancers of the lung, liver and bladder respectively. (Khurana, 1980). Mortality from colon and rectal cancers has been associated with higher income and education levels (Blot, et al, 1976). The same was recorded for breast and renal cancers (Blot and Fraumeni, 1979).

7. Geographical Differences :

Rates are higher for blacks of both sexes for cancers of the oesophagus, stomach, liver and pancreas and there is a substantial excess of prostate cancer in black males. However, the incidence of bladder cancer is lower in blacks (Rains et al, 1984). A number of cancer registries provide incidence data for different racial groups (Waterhouse et al, 1976). The age adjusted rates for stomach and large bowel cancer among Chinese living in the SanFrancisco area

are similar to those for whites, whereas rates for prostate and bladder cancer are lower. In Hawaii, the rates for stomach cancer are higher for Hawaiians and Japanese of both sexes and for Chinese and Filipino females than the corresponding rates for Caucasians (Young et al, 1987).

8. Changing Time Trends in Incidence and Morality :

Because of population growth and changes in its age distribution, the annual number of cancer cases is steadily increasing in USA. Apart from the smoking associated cancers, stomach and cervical cancers, the incidence of an mortality from cancer at nearby all sites have remained remarkably stable for the last 30 to 40 years (Devega and Silverman, 1978; Miller, 1980). There has been a slight increase in the rates of non-respiratory cancers for white males age 75 or more (but, if anything, a decrease at ages 50 to 59 and 40 to 44). In females an increase is shown in the 74 to 84 age group but decrease in the age groups 85 or more.

9. Religious Practices :

Religious groups whose life styles and dietary habits differ from those of the general population have been a fruitful source for assessing the possible effect of dietary variables. A study conducted by Philips and colleagues (1980) on seventh-day adventists who abstained from smoking and drinking and mainly followed a lacto-ovo-vegetarian diet showed that colorectal cancer was less among them and also that breast cancer risk was lower for the women of this group.

In India, cancer incidence differs among religious groups, especially between the Parsi and Hindu communities of Bombay (Jussawalla, 1976). In the Parsi community, the rates of colon, rectal and breast cancer are substantially greater than those in the Hindu population, although they are not as high as those in Western countries.

10. Occupational Hazards and Environmental Pollutants :

Occupational hazards are often encountered in industry, agriculture, mining and other working environments. The Committee on Biologic Effects of Atmospheric Pollutants (1971) have confirmed the association between occupational exposure to asbestos and an excess incidence of bronchogenic cancer and the risk of cancer is higher, if the individual is a smoker (Selikoff et al, 1970).

Arsenic is usually considered carcinogenic for man, although various factory studies have produced conflicting data (WHO 1973). Studies conducted by Ji-Xiang Wang et al (1988), show that X-ray workers in China had a 50 per cent higher risk of developing cancer than the other specialities. Leu Kaemia, cancers of thyroid, breast and skin were strongly linked to radiation work. Melanoma is a form of skin cancer that occurs in people who are over exposed to the UV rays of the sun. It is common in parts of Australia and USA (Span, 1988). Radiation acts by causing mutation of the living cell which involves a change in the basic character of the cell (Khurana, 1980).

The panorama of air pollutants is varied, starting from smoke, coal dust, ash, ordinary dust, industrial wastes, vegetable matters, obnoxious gases and last but not the least, noise (WHO 1973).

The Royal College of Physicians (Stock, 1968), notes that deaths from cancers of stomach and intestine are significantly related to level of smoke pollution. A recent study by the U.S. Environmental Protection Agency (EPA, 1981), Wynder, (1981) linked high cancer rates in New Orleans with drinking water taken from the Mississippi River, which contained small amounts of carcinogens.

11. Tobacco :

It is estimated that in the USA in 1980 about 33 per cent of all cancer deaths in men and about 10 per cent in women were related to smoking. Foremost among the hazards of tobacco smoking is lung cancer. In Australasia, particularly high rates are recorded in Papua, New Guinea and among New Zealand and Maori women, who also have one of the highest rates of lung cancer in the world (Crofton, 1988).

Studies relating passive smoking to risk of lung cancer have been reviewed by the International Agency for Research on Cancer, which considered that the health risks posed on children, (that is, passive smokers), whose parents smoke, were at greater, than the children, whose parents did not smoke (IARC, 1982).

Cigarettes smoking doubles the risk of bladder cancer in males and increases it to a lesser extent in females. The increasing prevalance of pancreatic cancer in many countries is due to smoking. The risk of pipe and cigar smokers to a cancers of mouth, larynx, and oesophagus, is as great as for cigarette smokers. If both alcohol and tobacco are used the risk of suffering from one of those cancers becomes even higher. More than twice as many men as women die from cancer of the oral cavity (Ball, 1986).

12. Synergism Between Alcohol and Smoking :

A number of reports implicate specific alcoholic beverages as risk factors for cancers at certain sites. Kono and Ikeda (1979) found suggestive correlations for males between cancer of the esophagus and intake of whiskey and saké. Collins et al (1972) ascribed the high frequency of esophageal cancer in African population to the consumption of an alcoholic beverge prepared from maize. Hoey et al (1981), reported that the consumption of alcohol (primarily red wine) increased the risk of adenocarcinoma of the stomach, in Lyon, France.

Studies have confirmed the interaction between alcohol consumption and smoking for cancers of the oral cavity and the esophagus; these findings support an interactive role between tobacco and alcohol in tumorigenesis of the oral cavity, the larynx, and esophagus (Burch et al, 1981; Pottern et al, 1981, Rothman and Keller, 1972; Wapnick et al. 1972). Avoidance of tobacco and alcohol by males could effect a marked reduction of these cancers. Synergistic effects of alcohol and tobacco have been observed in smokers consuming 45 ml or more of ethanol per day (Schottenfeld, 1979) and McCoy et al, 1979) reports by Rothman (1980) and Burch et al (1981), indicate that the risk for cancers of the oral cavity is slightly increased in smokers reporting low to moderate consumption of ethanol (ie., 12 to 45 ml, or approximately 70 to 270 calories daily.

13. Betel Chewing :

The chewing of 'Quids' composed of betal nuts (Areca catechu), lime and tobacco leaf, has been associated with an increased

incidence of oral cancer in man. Atleast7 reduced pyridins, alkaloids are present in these nuts and of the these arecadine and its methyl ester, arecoline have received greatest attention as the possible carcinogenic agents (Ashby, 1979). Chewing betel nuts that contain tobacco, a habit widespread in Asia, is also associated with mouth cancer (Wynder, 1981). Epidemiological studies by the ICMR are underway, in order to determine whether or not panmasala products are carcinognic, as a large number of the Indian population consume it on a daily basis (The Hindu, April 12, 1989).

14. Coffee Consumption :

There have been suggestions that coffeine exacerbates fibrocystic disease of the breast and may be a casual factor in breast cancer. Data from this study by Phelps and Phelps (1988) do not support a positive association between caffeine intake and subsequent development of breast cancer. Coffee drinking has been associated with elevated risk for bladder cancer in several case control studies (Bross and Tidings, 1973, 1975). Fraumeni et al., 1971; Howe et al., 1980; Miller et al 1978; Simon et al, 1975; Wynder and Goldsmith 1982). In January 1981, a University of Maryland found that drinking decaffeinated coffee was a risk factor for pancreatic cancer, as it is treated with a coffeine solvent, methylene chloride, a chemical suspected of being a carcinogen. Hsich et al (1981) and later Clavel et al (1987) reported risks of pancreatic cancer associated with coffee consumption. There is a positive relationship between coffee consumption and serum total cholesterol concentration along with a reduced risk for cancer of the colon. It is proposed that coffee contains substances that reduce the excretion of bile acids or neutral steroids (Willet, 1987).

15. Hormones - Oral Contraceptive Pill Consumption :

Hormones have been definitely found to promote cancer of the reproductive organs in both males and females and also breast cancer in women. For this reason hormones have a definite place in the treatment of some cancers (Kulkarni, 1980). Oestrogen in the form of birth control pills can promote the growth of breast cancer but it protects against heart disease. Another well estabilished oestrogen risk is endometrial cancer which strikes the linking of the uterus. This cancer is relatively rare, occuring annually in about 83 women per 100,000 over age 50 (Perlman, 1989). In another study it was found that the use of oral contraceptives reduces the risk of epithelial ovarian cancer (The National Institute of Child Health and Human Development, 1987).

16. Naturally Occuring Carcinogens :

The production of toxic, carcinogenic compounds by some microbes and plant cells has long been recognised. Of these mycotoxins, resulting from metabolism of molds is most important. Aflatoxin contamination of peanuts, cour, cotton seeds and walnuts was found to precipitate liver cancer in Africa (Keen and Martin, 1971). Other less important concinogenic substances found in foods include patulin, hydrazines in mushrooms, pyrrolizidine alkaloids, brakenferntoxins, methylxanthines, cycasin, thiourea, tannins and tannic acids, and nitroso compounds (National Academy of Sciences, 1981).

17. Mutagens in Food :

In several extensive studies conducted in independent laboratories, the correlations between mutagenic activity in bacteria and

carcinogenicity in mammals have been analysed (McCann et al, 1975; Simmon et al, 1979, 1986). It is clear that a chemical found to be mutagenic in any living system should be suspected to being carcinogenic (Parchase et al, 1987) Benzopyrenes, Polynuclear aromatic hydrocarbons, plant flavonoids, and mutagens from pyrolised proteins and amino acids found in a variety of smoked foods and in roasted coffee have proved to be carcinogenic in mammals (Howard et al, 1980).

18. Food Additives and Environmental Contaminants :

Studies conducted by Howe et al (1977) and Hoover and Strasser (1980), show a clear association between the use of saccharin and pancreatic cancer other good additives such as vinyl chloride, and acrylonitrile have been found to be mutagenic (Jukes, 1984).

Many pesticides in food are known or suspected of being carcinogenic in some animal and human species. Residues of pesticides have been found to cause liver cancer in a study in Tokyo, (Chu Zhi, 1988). But at present, there is no clear evidence suggesting that the use of food addivities has contributed significantly to the overall risk of cancer for humans (Mc Leod, 1981).

19. Associations with Other Diseases :

In general, hepatomas are found in individuals with cirrhosis of liver. Agents such as alcohol, hepatitis antigen, and aflatoxin, which result in hepatic injury leading to cirrhosis may contribute to the development of hepatomas through this pathway (Hieber, et al, 1979). Women suffering from endometrial cancer were most often than not obese, and diabetic, in nature (Rain, et al, 1988).

20. Intersite Correlations of Incidence :

Winkelstein et al (1977) studied the geographic variation in the occurance of cancer at sites common to both sexes and at five sex-specific sites. They found strong correlations among the incidence rates for cancer at three gastro-intestinal sites, ie., cancer of colon and rectum were directly correlated with each other, and inversely correlated with stomach cancer. In addition there was a strong direct correlation between colorectal and bladder cancers in both men and women and also between cancer of breast, corpus uteri and ovary in women. Berg (1975) pointed out that international incidence rates for the hormone dependent cancers (ie., Breast, corpus uteri, and ovavian cancers in females and testis and prostate cancers in males) were closely correlated with the rates for large bowel cancer.

D. Relationship Between Nutrients and Cancer :

There are certain nutrients which help to inhibit or reduce the impact of cancer cells (Shils, 1982).

1. Macronutrients :

(a) Total Caloric Intake :

Beig (1975) pointed out that the international distribution of hormone-dependent cancers has generated suspicion that these cancers may be related to affluence. He suggested that diets typical of affluent populations when ingested since childhood, could overstimulate the endocrine system, lead to aberratious in metabolic processes, and result in cancer. In a correlation study conducted by Armstrong and Doll (1975) the per capita income was highly correlated with the

intake of total fat, total protein and animal protein (Gaskin, et al, 1979). It cannot be assumed that obesity as such is the major risk factor. Nonetheless, most studies confirm a relationship between obesity and caloric intake. It is reasonable to assume that high total coloric intake is a risk factor for some sites, as identified in other studies (Miller, et al, 1978; Jain et al, 1980).

(b) Carbohydrates :

The intake of sugar was correlated with increased mortality from pancreatic cancer in women only, and the intake of potatoes was correlated with increased mortality from liver cancer in both sexes. In other studies, a high mortality intake of refined sugar and a low intake of starch have been associated with an increased incidence of breast cancer. Frequent consumption of starch has been associated with a high incidence of gastric cancer in one case control study and with esophageal cancer in another (NRC,1981).

(c) Protein :

Dietary protein has often been associated with cancers of the breast (Armstrong and Doll, 1975), endometrium (Hirayama, 1977), prostate (Kolonel et al, 1981), colorectum (Doll and peto 1978), Pancreas (Hirayama, 1977; Armstrong and Doll, 1975; Lea, 1967) and Kidney (Shils, 1987). However since the major dietary sources of protein (such as meat contain a variety of other nutrients and nonnutritive compounds, the association of protein with cancer at these sites may not be direct, but, rather could reflect the action of another constituent concurrently present in protein-rich foods.

(d) Fat and Cholesterol :

In various populations, both the high incidence of and mortality from breast cancer have been shown to correlate strongly with higher percapita fat intake (Reddy et al, 1984). Increased risk of large bowel cancer has been aossicated with higher fat intake (Doll et al, 1978). Many studies of serum cholesterol levels and cancer mortality have indicated that there is an inverse assoication with colon cancer, in males but the evidence is inconsistent and is not sufficient to establish a casual relationship (Reddy et al, 1985).

2. Micronutrients :

(a) Vitamins :

Deficiencies of certain vitamins have been associated with an increased incidence of spontaneous tumors in mammals. Vitamin A and Carotene deficiencies have been related to the development of odontomas and salivary gland tumors (Bjelke, 1975). Machennon et al, (1977) found an inverse association between consumption of green, leafy vegetables and lung cancer, among Chinese, females in Singapore (Smith and Jack, 1978, Gregor et al, 1980, Shekelle et al, 1981, Graham et al, 1981, Schaitzler 1981). Formerly Ascocbic acid, was considered on a cure for specific cancers (Cameron and Pauling, 1974) but long term studies by Mayo clinic (1989) have revealed that ascorbic acid does not inhibit carcinogenesis. Cook and Mc.Namara (1980), Watterberg (1972), Mamur et al, 1977 and others have conducted studies on the effects of tocopherol and B-complex vitamins in rats and other experimental animals but as inadequate investigations have been conducted in human beings, no conclusions can be drawn.

(b) Minerals :

Schroeder and his associates investigated the carcinogenicity of trace elements in a series of large experiments extending over 15 years. Magnesium deficiency in rats have been reported to induce an invasive thymoma (Schoeder, 1984). A cereal-based diet low in iodide has led to increased frequency of thyroid tumors and pituitary enlargement (Wynder, et al, 1980). As regards the aetiology and pathogenesis of cancer, opinion differs concerning the role of zinc, copper and iron. A high zinc intake has been reported to reduce the incidence of certain malignant tumors as well as to increase the proliferation of malignant cells (Mathur. 1978). The role of copper in cancer growth seems to be complex. Results of several investigations indicate that serum copper concentrations are very high in patients with malignant tumors. Similar trends are observed for serum ferritin (Jacobs, et al, 1975). Contradictory observations were noticed with regard to selenium by Shamberger et al (1976) and Jansson et al, (1975, 1978). In epidemiological studies conducted in Sweden, iron deficiency was associated with increased risk for cancer of upper alimentary tract (Larson et al, 1985).

3. Dietary Fibre :

A diminished fibre content in the diet, leads to faecal stasis, which may enhance tumor formation by concentrating carcinogens and by ensuring their prolonged contact with the bowel mucosa, 1984). Most international correlation studies from Scandinowa and U.K. show a relationship between colo-rectal cancer and mortality and a fibre deficient diet. But in South Africa, this does not appear to hold true (Nova, et al, 1987).

E. Relationship of Diet to Cancer at Specific Sites :

The diet is generally associated with cancers of the gastro intestinal tract (ie., esophagus stomach, colon, rectum, pancreas and liver) and cancers of some sex hormone responsive sites (ie., breast, prostate, endometrium and ovary). There is also evidence that diet is associated to some degree with cancers of the respiratory system and bladder (Young et al., 1981).

(a) Oral and Pharyngeal Carcinoma :

The role of dietary factors uncertain, with either no relation being determined or with evidence that decreased intake of food containing vitamins A and C and carotenoids is a positive risk factor in causing oral cancer (Reddy, 1975). The incidence of Plumer-Vision syndrome and cancer has decreased in association with improved nutrition, improved health care, and decreasing number of pregnancies (Newberne, 1975).

(b) Esophageal Cancer :

This carcinoma has a world wide but variable distribtuion. The highest rates are observed in South Central Asia, including Turkey, Iran, China and the Soviet Union, related to diets high in bread and very low in vegetables, to poor socio economic status (Kolonel et al, 1980). In Japan it has been associated with the eating of wheat, dried and salted fish and pork (Nakajima, 1984).

(c) Lung Cancer :

It is now the most prevalent malignancy in the USA with cigarette smoking as a major risk factor, along with occupational

carcinogen exposure. It is apparent that populations subsisting primarily on cereals and starchy vegetables with abundance of refined sugar and fats, are more susceptible to oral and lung cancer (Shekelle, 1980). Serum beta-carotene has been inversely correlated to the incidence of lung cancer in Hawaii, Switzerland and Washington (Miller et al 1978, Wynder et al, 1977).

(d) Breast Cancer :

It is well known that cancer at this site is associated with thyroid hormonal activity and iodine deficiency, but diet has also been suspected as a major cause (Mann, et al, 1988). Risk factors also include the family history of the disease, early menarchy, multiparity, and first child after the age 30. Alcohol consumption has been repeatedly documented as a risk factor. A positive correlation between fat consumption and breast cancer mortality has been found in many epidemiological surveys (Miller et al, 1980 and Shils, 1987).

(e) Endometrial Cancer :

This is the second most common cancer in the female genital organs, the cervix being the first. Many patients were found to suffer from obesity, hypertension and diabetes (Way et al, 1983).

(f) Ovarian Cancer :

Though several case-control studies do not appear to relate ovarian carcinoma to obesity, an association has been found that the cancer patients ate foods higher in animal fat but consumed less vegetables (Miller, 1981). Annegers et al (1979) observed that obesity is not a risk factor for ovarian cancer.

F. Role of Soyabean as a Novel Protein :

Soyabean, one of the cheapest sources of protein available today, can be easily cultivated in a short duration of 80 to 90 days and it grows well on almost all types of soils, both under irrigated and rainfed conditions (Bressani et al, 1973). Soyabean occupies an intermediary position between legumes and oil seeds. It contains more protein, about (40-45 per cent) than most of the legumes but less fat (about 16-20 per cent) than oil seeds. The protein in soya is highly nutritious like milk or other legumes. It has a high content of one of the essential amino acids ie., lysine, which is very deficient in our staple food such as rice and wheat or other cereals (Neelakantan, et al, 1987).

A soya-ragi multimix, formulated by Vijayalakshmi et al, (1987) was recommended as a low cost, nutritious, multimix, used as a preschool child's snack and also a remedial and preventive meausre against PEM. Replacement of dietary animal with soyabean protein has been reported to reduce serum cholesterol in hyper lipidaemic individuals in several studies (Wolfe et al, 1981 Goldberget al, 1982), while others found no specific effect of soyabean (Shorey et al, 1981, Holmes et al, 1980). Tsai and Vinik, (1987) observed the role of soya polysaccharide in lowering post prandial plasma glucose in diabetic individuals.

Soya protein causes decreased sterol concentration and this might be of importance, as high fecal steroid concentration have been implicated as a risk factor for cancer of the large intestine (Mill et al, 1971; Reddy et al, 1975). The conclusion is that the

nutritional quality of isolated soya proteins is high and that this plant protein can serve as the sole source of EAA (Essential Amino Acids) and nitrogen for protein maintenance in adults (Young, et al, 1984).

Experimental Procedure

CHAPTER - III

EXPERIMENTAL PROCEDURE

The experimental procedure involved in the conduct of this investigation entitled "The Epidemiological aspects and supplementation studies of selected cancer patients" consisted of the following stages :

A. Selection of hospitals and patients.

B. Collection of records on the cancer incidence in and around Coimbatore

C. Formulation of interview schedule and conduct of survey.

D. Assessment of nutritional profiles of the selected cancer patients.

E. Conduct of supplementation study with Soya flour.

F. Conduct of nutrition education.

A. Selection of Hospitals and Patients

The investigator selected local hospitals in and around Coimbatore, which had special Oncology Departments and/or consultancy services available for cancer. The Valawadi Cancer Centre at Kuppuswamy G. Naidu Memorial Hospital was chosen as the main area for the conduct of the experiment, because it attracted cancer patients from not only Coimbatore City but also from places

within a radius of 70 to 80 Kms, namely Erode, Tirupur, Karur, Palladam, Pollachi, Mettupalayam, Nilgiris, Velandipalayam and neighbouring villages. The other hospitals selected were K.G. Hospital, Government Hospital, E.S.I. Hospital, a private clinic (of Dr. Velusamy, Skin Specialist, Mettupalayam) and Sheela Clinic.

The investigator after obtaining permission from the respective Hospital authorities, discussed her research problem with the radio oncologists, bio-chemists and dietetians. She then met the cancer patients, established rapport and explained the purpose of her study.

B. **Collection of records on the cancer incidence in and around Coimbatore**

With the kind cooperation of the doctors and managements of the selected hospitals, five year records (i.e., 1984-89) on the cancer incidence in and around Coimbatore City was reviewed. Information was collected regarding the types and percent incidence of cancers in the hospitals. But the inadequacy of records (in 2 hospitals) and lack of in-depth records, were hindering factors in this endeavour.

C. **Formulation of the Interview Schedule and Conduct of Survey**

In order to elucidate information on the distribution of various types of existing cancer and its related epidemiological aspects like sex, age profile, religion and community, occupation, socio-economic status, literacy status, personal and family history

dietary habits, food consumption and frequency of intake followed throughout their life and types of vessels used for cooking, personal habits such as pan-masala, betel nut or tobacco chewing, smoking and alcohol consumption, an interview schedule was formulated. The schedule formulated is appended in Appendix A.

All the available 211 patients at the time of this investigation were selected for the interview in the selected hospitals and the method of data collection followed was interview method.

Interview as a research tool is in a sense an oral type of questionnaire or schedule whereby the subject supplies the needed information in a face-to-face relationship. It is unique in that it involves the collection, of data through direct verbal interrelation between the interviewer and the interviewee or respondents. It affords a part of the human personality. It is relatively more flexible and permits explanation, adjustment and variation according to the situation. (Gupta, 1988).

Diet surveys constitute an essential part of any complete study on nutritional status of individuals or groups, providing essential information on nutrient intake levels, sources of nutrients, food habits and attitudes. Under conditions, where frank signs of malnutrition do not exist a survey of intake of nutrients may give an indication of the adequacy of the diet for promoting optimal nutrition of individual or groups. Initially the confidence and cooperation of the subject was secured, followed by eliciting information, by asking

the planned sequence of questions in a stimulating and encouraging manner.

D. Assessment of Nutritional Profiles of Selected Cancer Patients

'Nutritional Status' is the level of nourishment. It is the condition of the body resulting from the utilization of essential nutrients available to the body (Swaminathan 1982).

Due to the positive role of diet as an environmental risk factor in carcinogenesis, (Burkitt et al, 1978) it was decided to study this aspect in depth. Therefore the food consumption pattern and dietary habits were studied using the interview schedule and also, a three-day weighment survey was conducted to evaluate the actual nutrient intake of 20 randomly selected cancer patients.

The weighment method is the most reliable among the various methods commonly employed for studying the dietary intakes of population. This method consists of determining the quantity of each food item taken for cooking in the kitchen and also the weight of the cooked food. In other words, the food items or ingredients of all preparations should be weighed before and after cooking. The cooked food left after consumption is also weighed. The foods consumed by particular members of the family is weighed during meal times. From these data, the actual quantity of food consumed by the family member or members can be calculated (Swaminathan, 1982).

It has been observed that the physical state and body weight, were affected during carcinogenesis (Sunyer, 1980). Anthropometic measurements are useful criteria for assessing the nutritional status of the patients.

Bio-chemical assessment was conducted on the selected twenty cancer patients as against the 10 matched controls by drawing 8.0 ml. of venous blood. The matched controls were selected from the relatives of the cancer patients who had no reported history of cancer and were normal. The blood samples were obtained by vein puncture procedure (Oser, 1964) and stored with great care in sterilized bottles. Prior to clotting a sample of the blood was extracted for estimation of haemoglobin by the Cyanmethemoglobin method (Varley, 1981). The remaining blood samples were allowed to clot at room temperature for one and a half hours and centrifuged. The supernatant serum was collected using a rubber bulb pipette. This serum was used for the estimation of total protein, albumin, globulin, retinol and trace elements zinc and copper. Serum total proteins, albumin and globulin were estimated using Ortho Reagent I and II (Standard Laboratory Procedures, 1989). Serum retinol was estimated using the absorption spectrophotometry method (N I N, 1983). Serum iron was estimated using Wong's Method (N I N, 1982). The other trace elements zinc and copper (serum), were estimated using the Triple acid method (NRC, 1980). The details of the procedures for all the above bio-chemical parameters are found in Appendix B.

E. Conduct of Supplementation Study with Soyaflour

Under nutrition of a general or specific type can affect each aspect of the immune mechanisms of the organism. With respect to the cancer-bearing host, efforts can be made to improve immunity by improving the nutritional status, by modifying concentrations of certain nutrients (i.e. lipids) by providing a high-protein, low-fat diet to combat emaciation in cancer patients, a problem not uncommonly identified in underdeveloped and war stricken countries (Maurice, 1987).

Among the patients surveyed, the majority were oral (in men) and cervical (in women) cancer patients. As the oral cancer patients suffered from difficulty in chewing and swallowing, cervical cancer patients were selected for study. A majority of the cervical cancer patients belonged to low socio, economic group and exhibited traits like emaciation, weakness and poor body weight. So the investigator hypothesised that supplementation of diets of selected cervical (female) cancer patients with high-protein, defatted, deodorised soya flour might have ameliorating effects, on their poor nutritional and health status. Therefore a 3 month supplementation programme was launched.

Twelve out-patients, suffering from the same stage (State-II) of cervical cancer from among the 20 patients selected initially and who were cooperative and willing to participate in the supplementation study were chosen. Their ages ranged from 33 to 48 years, and their

body weights from 36 to 52 kg. Out of these eight were chosen as the experimental group and supplemented with soyaflour for 12 weeks, while the remaining 4 patients served as their matched controls, without the effect of supplementation.

Specially processed, high protein, defatted, deodorised soya flour supplied by the kind courtesy of Mr. Palaniappan (Managing Director of Sakthi Soya Private Limited, Coimbatore) was administered to the selected eight cervical cancer out-patients. The patients were provided with 100 g. packets of soya flour, on monthly basis. The patients were asked to consume 100 g of soya flour daily, distributed evenly in 3 meals. The investigator demonstrated standardised recipies using soya flour in their respective homes. These recipies were similar to the commonly used daily recipies of the respective patients. As the consumption of green leafy and other vegetables was found to be inadequate in most of their dietaries, amaranth and fenugreek seeds were supplied, to encourage kitchen gardening and increase their daily intake of fresh green leafy vegetables. Dietary counselling and nutrition education were also imparted by the investigator. These were made possible through daily counselling and living with the patients in their homes during the initial stages.

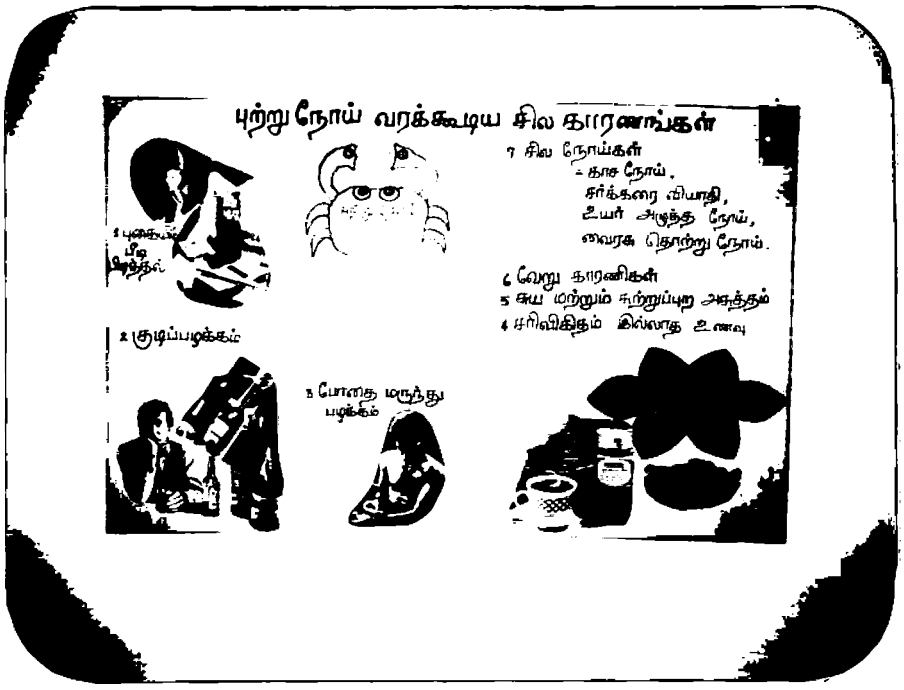
Later, weekly visits to the homes of the subjects, (In Tirupur, Mettupalayam, Erode, Palladam, Pollachi, Podanur and Perur) were done by the investigator to assure daily consumption of the supplement and during their visits the monthly quota of soya flour was given and their general health and well-being checked.

In the absence of standard and definite parameters, the impact of supplementation was evaluated by assessing the serum total protein, albumin, globulin, iron, haemoglobin, zinc and copper levels, changes in body weight and changes in the radiation dosage (in terms of rads administered to the patient before and after supplementation).

F. **Conduct of Nutrition Education Programme**

The importance of nutrition education as a means for improving the nutrition of the community in the developing countries has been increasingly realized during recent years (Swaminathan, 1983).

Dietary counselling and lectures, in the local language were conducted in the hospitals in Coimbatore and in the clinic in Mettupalayam. The lecture in Tamil is presented in Appendix I. Simple and colourful charts were used to explain the concepts of nutrition, with respect to cancer. Demonstration of standardised recipes using defatted, deodorised, high protein soya flour, were conducted followed by interaction between the investigator and the home makers (including the cancer patients). The standardised recipes are appended in Appendix J and plates I and II show the charts, pamphlets and standardised recipes used. Pamphlets in Tamil and English (provided by Sakthi Soya Limited and American Cancer Society) were distributed to the few literate cancer patients.



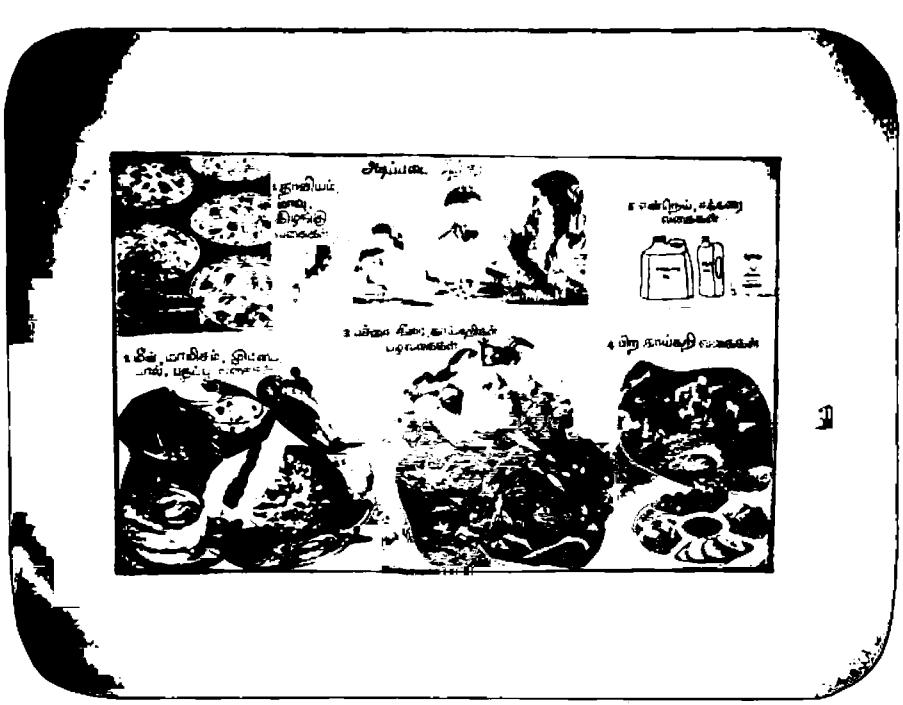


PLATE I

AIDS USED IN NUTRITION EDUCATION - CHARTS

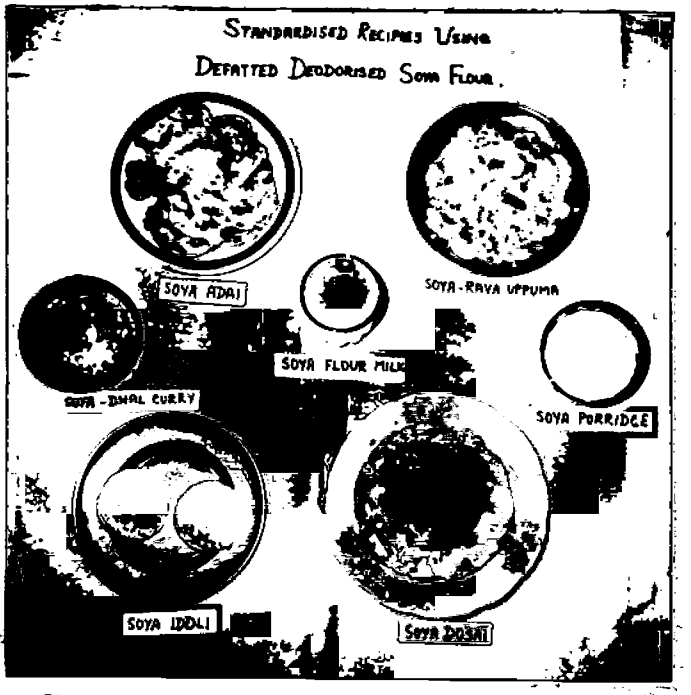


PLATE II.

AIDS USED IN NUTRITION EDUCATION

Results and Discussion

CHAPTER - IV

RESULTS AND DISCUSSION

The results of this study entitled the epidemiological aspects and supplementation studies of selected cancer patients are discussed under the following captions :

A. Trend in the prevalence of cancer incidence in and around Coimbatore

B. Background information on the lifestyle of the cancer patients

C. Dietary patterns of the cancer patients

D. Nutritional profile of the cancer patients

E. Impact evaluation of soya supplementation

A. Trends in the prevalance of cancer incidence in and around Coimbatore

From the records of the selected six hospitals in and around Coimbatore prevalence data on the cancer trends was collected for the past five years and the data is presented in Table I.

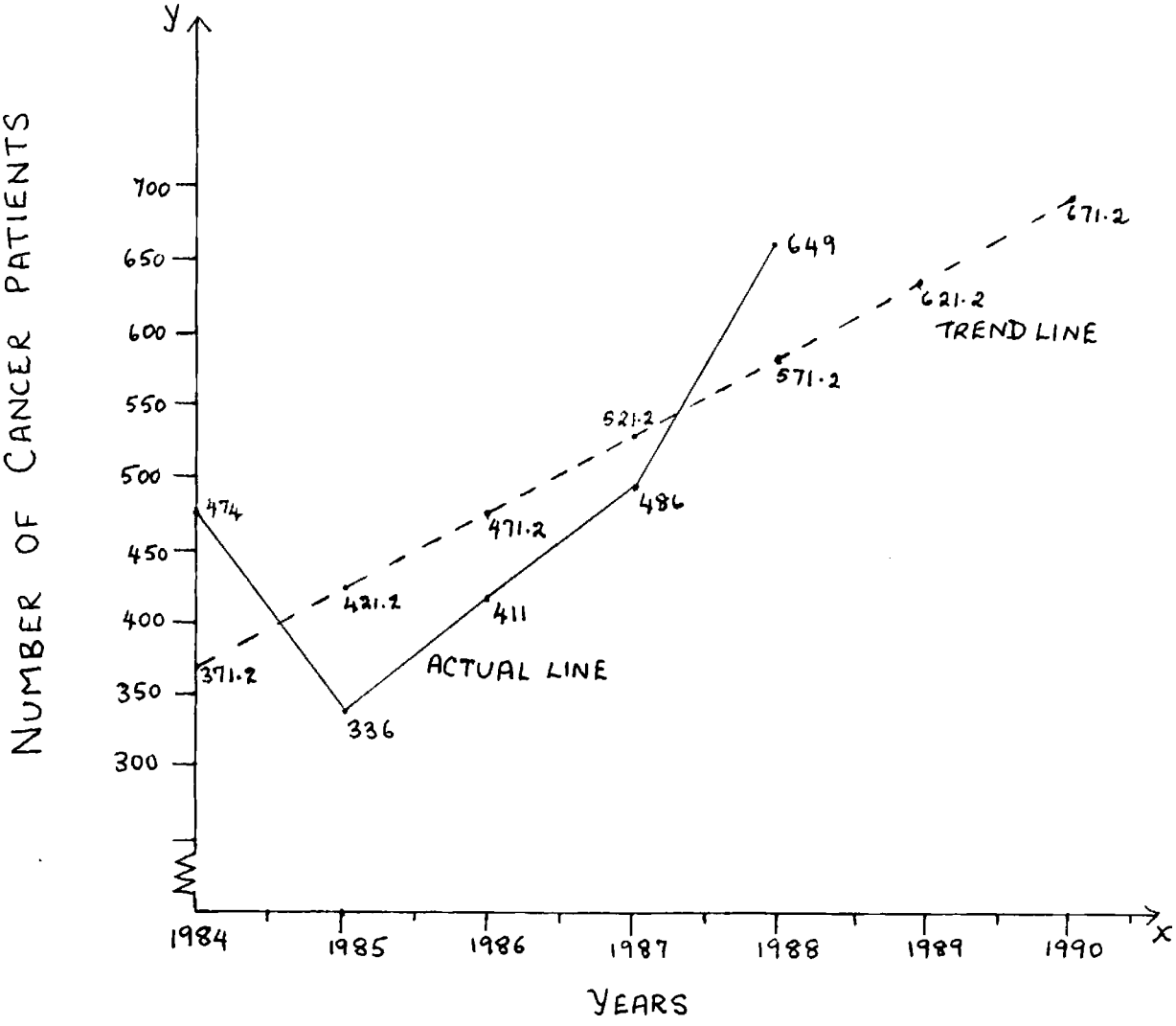
Table 1

Trend in the prevalance of cancer incidence in and around Coimbatore

Year	Hospitals						Total
	I	II	III	IV	V	VI	
1984	6	97	146	203	20	2	474
1985	17	43	174	71	31	0	336
1986	54	36	281	16	24	9	420
1987	80	12	299	93	2	0	486
1988	27	68	482	49	16	7	649
	184	**256**	**1382**	**432**	**93**	**18**	**2365**

As reported by Gupta (1988) given any long term series, a trend curve may be drawn to determine and present the direction which it takes, whether it is growing or declining. Therefore it was thought to be of interest, to determine the trend in ~~and~~ the prevalence of cancer incidence in and around Coimbatore. A trend curve of the cancer incidence in and around Coimbatore, is presented in Figure II.

Using the trend curve, it may be predicted that the number of cancer patients to be admitted in hospitals in and around Coimbatore, by the year 1990, will be approximately 671.2, indicating a definite rise in cancer incidence. In absolute number it may even be more due to changing lifestyle and population growth.



KEY:

ON X AXIS

1 cm = 0.5 YEAR

ON Y AXIS

1cm = 50 patients

TREND CURVE OF CANCER INCIDENCE IN AND AROUND COIMBATORE

FIGURE - 2.

B. Background Information on the Lifestyle of the Cancer Patients :

After interviewing 211 cancer patients, information regarding their age, sex, type of cancer, socio economic status and personal history were collected and consolidated. They are presented in the following pages.

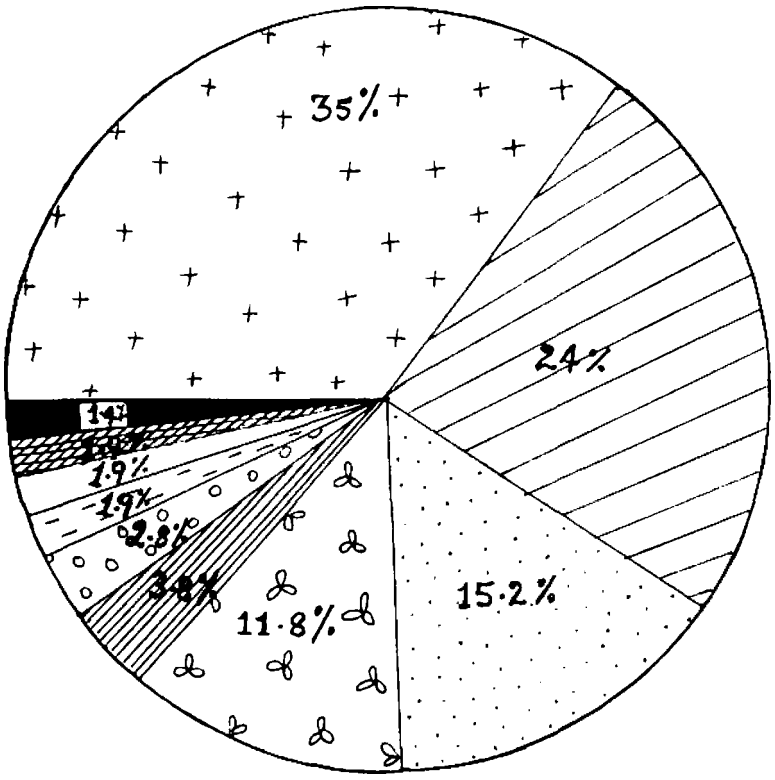
1. Distribution of patients according to the type of cancer :

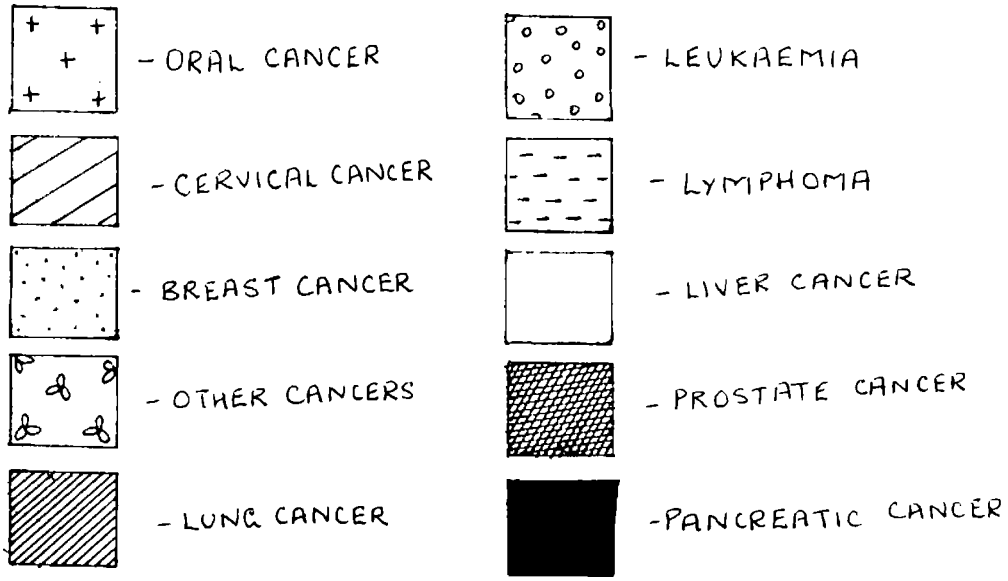
The prevalence of the types of cancer among the 211 samples in and around Coimbatore is presented in Table II and Figure III.

Table II

Distribution of cancer patients according to the types of cancer

S.No.	Types of Cancer	Number	Percentage
1	Cervix	51	24.2
2	Breast	32	15.2
3	Oral	74	35.1
4	Lung	8	3.8
5	Leukaemia	6	2.8
6	Genital organs (Prostate)	4	1.9
7	Liver	4	1.9
8	Lymphoma	4	1.9
9	Pancreas	3	1.4
10	Others (skin, stomach, thyroid, ear)	12	11.8
	Total	**211**	**100**





DISTRIBUTION OF CANCER TYPES IN THE PATIENTS

FIGURE - 3.

Oral cancer (mouth, tongue, oesophageal, larynx and pharynx) was the most common type of cancer (35 percent) followed by cervical cancer (24.2 percent) and breast cancer (15.2 percent). Among the category of others it may be noted that very few cases of melanoma (skin cancer) were observed (less than one percent) as the disease is supposed to be rare in black and oriental people, suggesting that skin pigment plays a genetic role in protecting against the disease (Wallersius, 1982).

No cases of colonic cancer were seen in the study and this may be attributed to the fibre content of Indian diets (Luthra, 1984). It has been reported that over the past 25 years the incidence of oral and lung cancers in men and women has increased drastically, due to the increase in smoking and alcohol consumption habits (Wynder, 1981). In the present study also oral cancer seems to be the most prominent one and this may be due to the smoking and chewing habits.

2. Sexwise Distribution of Cancer Patients

The sexwise distribution of the surveyed cancer patients, is presented in Table III.

Table III

Sexwise Distribution of Cancer Patients

S.No.	Types of Cancer	SEX			
		Male		Female	
		No.	%	No.	%
1.	Cervix	-	-	51	24.1
2.	Breast	-	-	32	15.2
3.	Oral	58	27.5	16	7.6
4.	Lymphoma	1	0.5	2	0.9
5.	Leukaemia	1	0.5	5	2.4
6.	Prostate	5	2.4	-	-
7.	Liver	3	1.4	1	0.5
8.	Pancreas	2	0.9	1	0.5
9.	Lung	7	3.3	1	0.5
10.	Others	15	7.1	10	4.7
	Total	**92**	**43.6**	**119**	**56.4**

The incidence of carcinoma of the uterine cervix has increased in recent years particularly amongst younger women in India. This has coincided with changing social patterns of greater sexual freedom and the use of oral contraceptives suggesting that a sexually transmissable agent (H.P.V.) may be the aetiological factor responsible (Abdulla, 1987).

3. Age profile of cancer patients

Age has a bearing on the incidence of specific cancers. The age profile of the cancer patients is presented in Table IV.

Table IV

Age profile of cancer patients

S.No.	Types of Cancer	AGE IN YEARS													
		0-10		11-20		21-30		31-40		41-50		51-60			
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1.	Cervix	-	-	1	0.5	4	1.9	20	9.5	20	9.5	8	3.8	-	-
2.	Breast	-	-	-	-	2	0.9	3	1.4	13	6.2	10	4.7	4	1.9
3.	Oral	-	-	1	0.5	3	1.4	12	5.7	25	11.8	20	9.5	12	5.7
4.	Lymphoma	-	-	-	-	-	-	1	0.5	2	0.9	-	-	-	-
5.	Leukaemia	5	2.4	1	0.5	-	-	-	-	-	-	-	-	-	-
6.	Genital Organs (Prostate)	-	-	-	-	1	0.5	1	0.5	2	0.9	-	-	-	-
7.	Liver	-	-	-	-	-	-	2	0.9	-	-	1	0.5	1	0.5
8.	Pancreas	-	-	-	-	-	-	2	0.9	-	-	-	-	-	-
9.	Lung	-	-	-	-	1	0.5	1	0.5	2	0.9	3	1.4	2	0.9
10.	Others	-	-	-	-	3	1.4	4	1.9	11	5.2	4	1.9	3	1.4
	Total	**5**	**2.4**	**3**	**1.4**	**14**	**6.6**	**46**	**21.8**	**75**	**35.5**	**46**	**21.8**	**22**	**10.4**

A little more than one-third of the patients (35.5 percent) of the age group 41 to 50 years, out of which 11.8 percent was contributed by oral cancer alone. Incidence of Leukaemia was found among the age group 0 to 11 years. This finding in tune with the study by Mc Leod, (1987).

4. Religion and Occurance of Cancer

The life styles and customs of various religious groups seems to have some association with the incidence of cancer (Dolls and Armstrong, 1982). So the religion to which the patients belonged and the incidence of the various types of cancer was surveyed and is tabulated in Table V.

Table V

Religion and Occurance of Cancer

S.No.	Types of Cancer	RELIGION							
		Hindu		Muslim		Christian		Others	
		No.	%	No.	%	No.	%	No.	%
1.	Cervix	43	20.4	1	0.5	7	3.3	7	3.3
2.	Breast	23	10.9	-	-	8	3.8	5	2.4
3.	Oral	66	31.3	3	1.4	2	0.9	7	3.3
4.	Lymphoma	2	0.9	-	-	1	0.5	-	-
5.	Leukaemia	5	2.4	-	-	1	0.5	1	0.5
6.	Prostate	4	1.9	-	-	1	0.5	1	0.5
7.	Liver	3	1.4	1	0.5	-	-	1	0.5
8.	Pancreas	2	0.9	-	-	1	0.5	-	-
9.	Lung	3	1.4	2	0.9	-	-	2	0.9
10.	Others	3	1.4	2	0.9	3	1.4	-	-
	Total	**154**	**73**	**9**	**4.3**	**24**	**11.4**	**24**	**11.4**

Majority of the patients were Hindus (73 percent) while 11.4 percent and 4.3 percent of the patients were Christians and Muslims respectively.

5. Geographical Distribution of Cancer Patients

Incidence of cancer varies appreciably in different parts of the world. This fact strongly suggests an enviornmental rather than a genetic aetiology (Mathur, 1988). Hence the geographical distribution of the cancer patients was studied and is presented in Table V1.

Table VI

Geographical Distribution of Cancer Patients

S.No.	Types of Cancer	Tamil Nadu		Kerala		Andhra		Foreign Countries		Gujarat		Others	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1.	Cervix	30	14.2	2	0.9	2	0.9	1	0.5	4	1.9	18	8.5
2.	Breast	15	7.1	2	0.9	1	0.5	3	1.4	2	0.9	9	4.3
3.	Oral	25	11.8	9	4.3	5	2.4	-	-	5	2.4	27	12.8
4.	Lymphoma	-	-	-	-	-	-	-	-	1	0.5	2	0.9
5.	Leukaemia	2	0.9	3	1.4	-	-	-	-	-	-	1	0.5
6.	Prostate	-	-	1	0.5	-	-	-	-	-	-	3	1.42
7.	Liver	-	-	1	0.5	-	-	-	-	-	-	1	0.5
8.	Pancreas	1	0.9	1	0.5	1	0.5	-	-	-	-	5	0.5
9.	Lung	2	0.9	1	0.5	1	0.5	-	-	-	-	5	2.4
10.	Others	4	1.9	2	0.9	3	1.4	2	0.9	-	-	12	5.7
	Total	**79**	**37.4**	**22**	**10.4**	**13**	**6.2**	**6**	**2.8**	**12**	**5.7**	**79**	**37.4**

Majority (37.4 percent) of the patients were natives of Tamilnadu. This high percentage may be because this study was conducted in Tamilnadu.

6. Income Levels and the incidence of Cancer

The income levels and the incidence of cancer is summed up in Table VII.

Table VII

Income Levels and Incidence of Cancer

S.No.	Types of Cancer	Income Rs. per month													
		Below 500		501-1000		1001-1500		1501-2000		2001 2500		2501-3000		3001 & above	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1.	Cervix	3	1.4	12	5.7	4	1.9	9	4.3	5	2.4	4	1.9	8	3.8
2.	Breast	14	6.6	15	7.1	6	2.8	4	1.9	9	4.3	2	0.9	14	6.6
3.	Oral	5	2.4	11	5.2	4	1.9	12	5.7	5	2.4	7	3.3	7	3.3
4.	Lymphoma	1	0.5	-	-	2	0.9	1	0.5	1	0.5	-	-	1	0.5
5.	Leukemia	-	-	-	-	1	0.5	1	0.5	1	0.5	2	0.9	-	-
6.	Prostate (Genita-longans)	-	-	-	-	1	0.5	1	0.5	1	0.5	-	-	-	-
7.	Liver	-	-	-	-	1	0.5	2	0.9	-	-	-	-	1	0.5
8.	Pancreas	-	-	-	-	2	0.9	1	0.5	1	0.5	-	-	-	-
9.	Lung	-	-	1	0.5	3	1.4	-	-	1	0.5	1	0.5	3	1.4
10.	Others	1	0.5	2	0.9	-	-	2	0.9	3	1.4	7	3.3	5	2.4
	Total	**24**	**11.4**	**41**	**19.4**	**24**	**11.4**	**33**	**15.6**	**27**	**12.8**	**23**	**10.9**	**39**	**18.5**

Out of the patients surveyed 60.7 percent were employed while 39.3 percent were unemployed. Patients belonging to the low socio-economic group earning Rs. 501 - 1000/- per month constituted 19.4 percent. It was followed closely by patients belonging to the high socio-economic group (18.5 percent) earnings amounting to Rs. 3001 and more per month. Hence as far as the observations of this study is concerned there does not seem to be any relationship between incidence of cancer and socio-economic status.

7. Literacy Status

The literary status of the cancer patients is presented in Table VIII.

Table VIII

Literacy Status

S.No.	Types of Cancer	Literates		Illiterates	
		No.	%	No.	%
1.	Breast	20	9.5	12	5.7
2.	Cervix	38	18.0	13	6.2
3.	Oral	52	24.6	22	10.4
4.	Lymphoma	3	1.4	1	0.5
5.	Leukemia	5	2.4	1	0.5
6.	Genital organs (prostate)	4	1.9	-	-
7.	Liver	3	1.4	1	0.5
8.	Pancreas	2	0.9	1	0.5
9.	Lung	4	1.9	4	1.9
10.	Others	13	6.2	12	5.7
	Total	**144**	**68.2**	**67**	**31.8**

Majority of the patients studied were literates (68.2 percent) while 31.8 percent, were illiterates. It was however observed by the investigator during the survey that most of the patients had poor nutritional and health knowledge.

8. Association of Cancer with other Diseases

It has been hypothesized that certain diseases and infections are associated with cancers at specific sites. The association of cancer with other diseases is presented in Table IX.

Table IX

Assocation with other Diseases

S.No.		DISEASES																					
		Diabetes		Hyperten-sion		Ischemia		Asthma		Ulcer		Rheumatism		Tuber-cluosis		Filariasis		Fibroid uterus		Thyroid disease		Others	
		No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
1.	Breast	2	1.0	3	1.4	-	-	-	-	-	-	-	-	1	0.5	-	-	-	-	-	-	3	1.4
2.	Cervix	3	1.4	2	1.0	-	-	1	0.5	1	0.5	1	0.5	-	-	-	-	8	3.8	0	-	21	10.0
3.	Oral	-	-	3	1.4	2	1.0	1	0.5	1	0.5	2	1.0	1	0.5	1	0.5	-	-	-	-	-	-
4.	Lymph-onia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.	Leuka-emia																						
6.	(Genital organs (prostate)	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.5
7.	Liver	1	0.5	-	-	-	-	-	-	-	-	-	-	1	0.5	-	-	-	-	-	-	4	1.9
8.	Pancreas	2	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1.4
9.	Lung	-	-	-	-	1	0.5	1	0.5	-	-	-	-	1	0.5	-	-	-	-	-	-	1	0.5
10.	Others	-	-	1	0.5	1	0.5	2	1.0	1	0.5	-	-	-	-	-	-	-	-	-	-	2	1.0
	Total	**10**	**4.9**	**9**	**4.3**	**4**	**2.0**	**5**	**2.5**	**3**	**1.5**	**2**	**1.0**	**4**	**2.0**	**1**	**0.5**	**8**	**3.8**	**0**	**0**	**35**	**16.7**

Seventeen percent of the patients suffered from other diseases including viral fever and HPV (Human Papilloma Virus) infection [in the case of women patients]. When considering the other diseases the patients suffered from Diabetes Mellitus (4.9 percent), Hypertension (4.3 percent) and Fibroid Uterus (3.8 percent, in the case of women). These findings were in accordance with those reported by Jussawalla (1987, 1989).

9. Age at Menarchy and Incidence of Cancer

Cervical cancer is believed to be caused by HPV (Human Papilloma Virus), factors such as early marriage, early menarchy (where a girls' cervix is not mature enough to withstand any damage), promiscuity and multiple partners. (Luthra, 1989; Kotwal, 1986; Sudha, 1988). Hence these factors were studied and the age of menarchy is presented in Table X.

Table X

Age at Menarchy and Incidence of Cancer

S.No.	Types of Cancer	Age of Menarchy (Years)							
		7-9		10-12		13-15		16-18	
		No.	%	No	%	No.	%	No.	%
1	Cervix	7	5.9	14	11.8	13	10.9	-	-
2	Breast	7	5.9	28	23.5	16	13.4	-	-
3	Oral	2	1.7	22	18.5	5	4.2	2	1.7
4	Others	3	2.5	2	1.7	-	-	-	-
	Total	**19**	**16.0**	**64**	**53.8**	**34**	**28.6**	**2**	**1.7**

In the present study 53.8 percent of the women, started their menstruation cycle between the ages 10 to 12 years. The maximum number of pregnancies (36.7 percent) were 3 to 4. Consanguinity was exhibited by 16 percent of the women, characterised by marriages between uncle and niece, exhibited mainly by the Gounder Community, Majority of the women (61.7 percent) underwent menopause between the ages of 45 to 50 years.

10. Relation of Tobacco, Chewing, Cigarette Smoking and Alcoholism to Oral, Lung, Liver and Pancreatic Cancers

The increase of lung cancer deaths in the past twenty years has been in direct proportion to the increase of cigarette sales (Singh, 1988). Of all the lung, oral, lever and pancreatic cancer patients studied in hospitals in recent years, more than 95 percent admit that they have been moderate to heavy smokers and/or drinkers for long periods (Ochsner, 1974).

The relation of smoking cigarettes or beedi, tobacco chewing or sniffing tobacco and drinking crude alcohol (arrack, toddy, germinated millet beverages) or distilled liquors (rum, gin, beer, whisky etc.) has been studied and presented in Table XI.

Table XI

Relation of Tobacco Consumption and Alcoholism to Oral, Lung, Liver and Pancreatic Cancer

S.No.	Types of Cancer	Tobacco Consumption			Alcohol Consumption		
		No.	%	Average no. of beedi/ cigarettes smoked	No.	%	Average amount of alcohol consumed ml/day
1	Oral	28	31.5	12	23	25.8	188
2	Lung	2	2.2	14	3	3.4	85
3	Pancreatic	1	1.1	4	3	3.4	90
4	Liver	2	2.2	8	2	2.2	120
	Total	**33**	**37.0**	**9.5**	**31**	**34.8**	**120**

Out of the 89 patients suffering from oral, lung, liver or pancreatic cancer, 37 percent, used tobacco habitually and the average number of cigarettes or beedis smoked was 9 to 10, in number. One third of the patients smoked daily (30.3 percent). Thirty five percent of the patients consumed liquor, on an average 120 ml per day. Nineteen percent of drinkers, consumed alcohol daily. Thirty two percent and twenty six percent of smokers and drinkers, suffered from oral cancer, respectively. Thus, it may be inferred that heavy smokers and drinkers are at a greater risk of oral cancers and/or lung cancer as stated by (Ochsner, 1976).

C. Dietary Patterns of the Cancer Patients

There is positive evidence that dietary factors are important in the pathogenesis of cancer (Rains et al, 1981). Therefore the dietary patterns of the surveyed cancer patients were studied and the results are presented and discussed under the following topics :

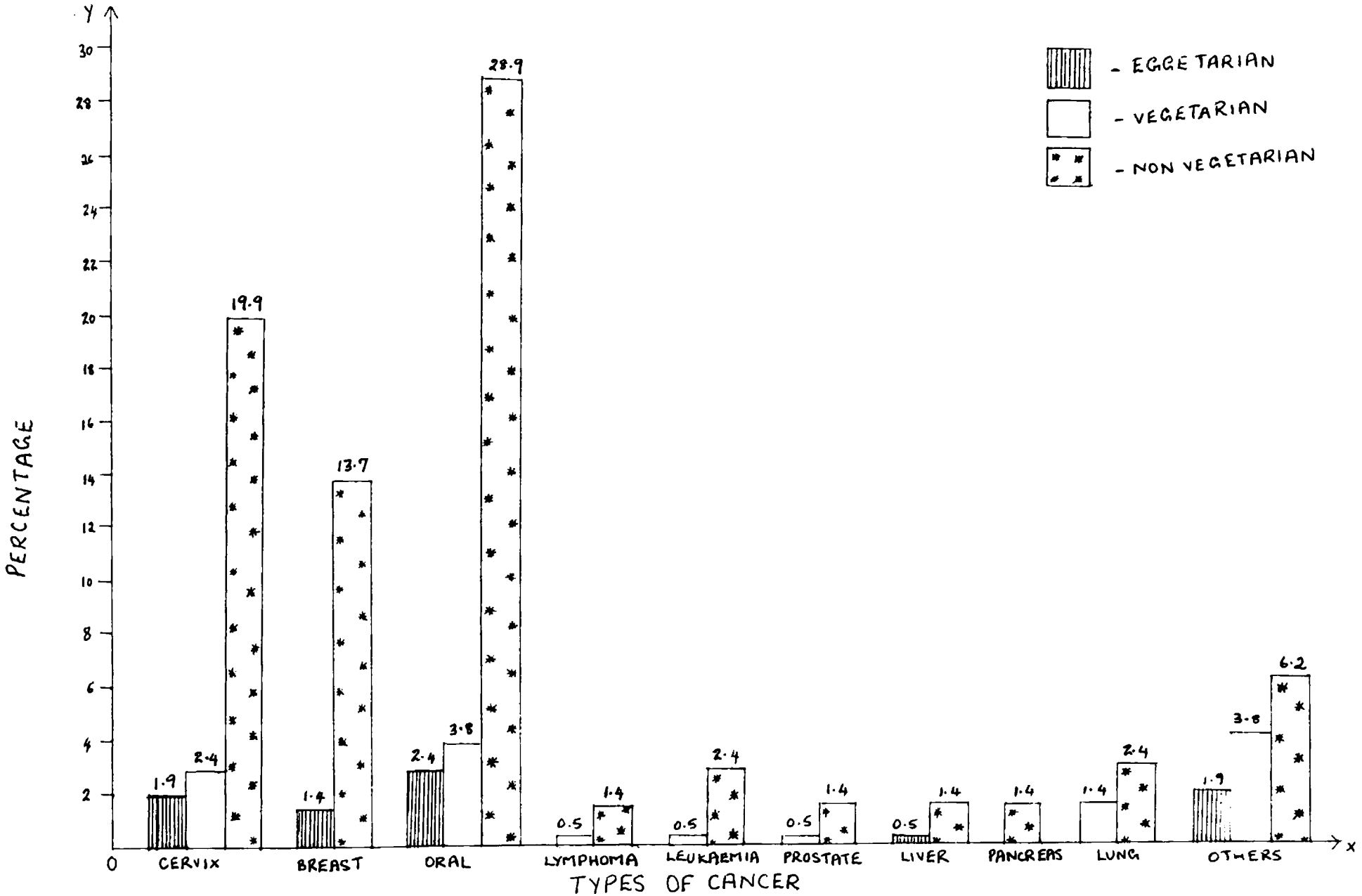
1. Vegetarianism and Incidence of Cancer

The distribution of vegetarians, non-vegetarians and eggetarians among the selected samples, is presented in Table XII and Figure IV.

Table XII

Vegetarianism and Incidence of Cancer

S.No.	Types of Cancer	Vegetarian		Non-Vegetarian		Eggetarian	
		No.	%	No.	%	No.	%
1	Cervix	5	2.4	42	19.9	4	1.9
2.	Breast	3	1.4	29	13.7	-	-
3.	Oral	8	3.8	61	28.9	5	2.4
4.	Lymphoma	1	0.5	3	1.4	-	-
5.	Leukaemia	1	0.5	5	2.4	-	-
6.	Genetial organs	1	0.5	3	1.4	1	0.5
7.	Liver	-	-	3	1.4	-	-
8.	Pancreas	-	-	3	1.4	-	0.5
9.	Lung	3	1.4	5	2.4	-	-
10.	Others	8	3.8	13	79.1	4	1.9
	Total	**30**	**14.2**	**167**	**79.1**	**14**	**6.7**



PERCENTAGE DISTRIBUTION OF VEGETARIANS, EGGETARIANS AND NON-VEGETARIANS AMONG THE PATIENTS.

FIGURE - 4.

Among the patients surveyed, a majority were non-vegetarians (79.1 percent), while vegetarians and eggetarians constituted only a minor portion, (14.2 percent and 6.7 percent respectively). This finding is inaccordance with the studies by the National Cancer Research Insitute in Tokyo (1987) which have demonstrated a conclusive relationship between increased vegetable consumption and reduced risk of cancer mortality, also the increased consumption of beef and other meats, was associated with increased incidence of breast, and other cancers.

2. Frequency of Food Consumption

The details of the food consumption pattern was studied. The table giving the frequency of food consumption is appended (Appendix C).

Of the 211 patients, 96.7 percent consumed a rice based diet. The millets, ragi, sorgum and maize, were consumed as breakfast items by a very small segment of the patients.

Majority of the patients consumed pulses and milk, but in inadequate amounts. The consumption of fresh fruits and raw vegetables, especially green leafy vegetables was found to be very low among the cancer patients. The intake of roots and tubers was more than that of other vegetables. About 40 - 60g of egg, beef and mutton were consumed once a week. Palm oil was the main cooking oil used. Five to six grams of gingelly oil, coconut oil, ghee and butter, were used daily or alternatively, in addition to an average daily intake

of 20g of palm oil. Though buttermilk was consumed daily, dilution reduced the quality. The intake of highly refined foods including sugar, jaggery, sweets, savory snacks, pappads and biscuits and bread was considerable. According to Writes (1985) excess of starch and sugar may lead to induction of cancer by providing sufficient energy for tumour growth, wherein limiting the intake of highly refined foods has shown reduced incidence.

3. Food and Nutrient intake of Randomly Selected Cancer Patients :

a) Food Intake

The food consumption pattern of the randomly selected cancer patients is presented in Table XIII. The individual values are given in Appendix D_1 and D_2.

(b) Nutrient Intake

The mean nutrient intake of (6 men and 14 women) twenty randomly selected cancer patients is presented in Table XIV. The individual values are given in Appendix E_1 and E_2.

A three - day weighment survey conducted, to elicit information on the average nutrient intake of the randomly selected cancer patients indicated that the intake of nutrients was lower than the Recommended Dietary allowances proposed by I C M R (1981), especially with regard to carotene, riboflavin and iron. The ascorbic acid intake of women was greater than that of men.

Table XIII

Food Intake of the Randomly Selected Cancer Patients

S.No.		Number Surveyed	Cereals g	Pulses g	Green leafy vege-tables g	Other Vege-tables g	Roots & Tubers g	Milk and its pro-ducts g	Fats and oils g	Sugar and Jag-gery g	Fruits g
1.	Men	6	389	23.5	3.3	6.2	22.7	78.3	23.3	22.3	10.8
	R.D.A.		460	40	40	60	50	150	40	30	30
	Deficit/Excess		71	16.5	36.7	53.8	27.3	71.7	16.7	7.7	19.2
2.	Women	14	349	25	7.4	11.3	33.3	41.6	22.7	24.2	18.8
	R.D.A		410	40	100	40	50	100	20	20	30
	Deficit/Excess		61	15	92.6	28.7	16.7	58.4	+2.7	+4.2	11.2

Table XIV

Nutrient Intake of the Randomly Selected Cancer Patients

S.No.		Number Surveyed	Energy calorie	Protein g	Fat g	Fibre g	Calcium g	Iron g	Carotene mcg	Thiamine mg	Riboflavin mg	Niacin mg	Vitamin C g
1.	Men	6	1701	37.7	32.2	2.6	240	17.7	505	1.0	0.43	12.7	10
	R.D.A		2400	55	-	-	400-500	24	3000	1.2	1.4	16	40
	Deficit		699	17.3	-	-	160	6.3	2495	0.2	0.97	3.3	30
2.	Women	14	1794	34.1	-	-	374	17.2	474	0.97	0.49	11.3	26
	R.D.A.		1900	45	-	-	400-500	32	3000	1.0	1.1	13	40
	Deficit		196	10.9	-	-	26	14.8	2526	0.03	0.61	1.7	14

In general, the quantity of food consumed was low when compared to the Recommended Dietary Allowances proposed by I.C.M.R. (1981). This may be due to food beliefs, traditions and dislikes, nausea and anorexia affecting the patients, especially after radiotherapy (Swenson, 1982, Carrell et al, 1986). Surgery, bleeding (haemorrhages) and tumour growth in the oral cavity, resulted in nausea and difficulty in masticating and swallowing food (Karmali, 1987).

Numerous epidemologic studies (Colditz et al, 1985; Doll and Peto, 1981; Graham and Dayal, 1978; Shekelle et al, 1981) have shown that cancer risk is inversely related to the consumption of fruits and green and yellow vegetables. Retrospective studies of green and other vegetables and risk of lung (Decosta, 1977), gastro intestinal (Modan, 1981), bladder (Mettlin, 1979), colonic and cervical (Marshall. et al, 1983) cancers have found inverse relationships.

D. Nutritional Profile of the Cancer Patients

The nutritional profile of the selected 20 cancer patients and the matched controls were studied by assessing the body weight and the serum concentration of certain nutrients. A single blood sample was drawn to estimate the mean serum concentration of total proteins, albumin, globuin, retinol, haemoglobin, iron, copper and zinc. The type of blood groups was also studied. The serum concentration of certain nutrients of the selected cancer patients and their matched controls is given in Table XV and the individual values in Appendix F_1 and F_2.

TABLE - XV

Nutritional Profile of Cancer Patients

S.No.	Nutrition Parameters	Leves of Nutrients	
		Patients [Number = 20]	Matched Control [Number = 10]
1.	Total proteins [g/dl]	5.3 ± 0.29	7.13 ± 0.33
2.	Albumin [g/dl]	3.28 ± 0.39	4.56 ± 0.19
3.	Globulin [g/dl]	2.02 ± 0.13	2.57 ± 0.10
4.	A : G Ratio	1.69 : 1	1.81 : 1
5.	Haemoglobin [g/dl]	10.04 ± 0.74	13.33 ± 0.25
6.	Iron [mcg/dl]	80.41 ± 45.71	106.77 ± 10.50
7.	Retinol [mcg/dl]	22.44 ± 5.18	47.35 ± 9.41
8.	Copper [mcg/dl]	1.110 ± 0.020	0.890 ± 0.004
9.	Zinc [mcg/dl]	0.561 ± 0.020	0.947 ± 0.009

On comparing the serum micronutrient levels of the cancer patients with those of their normal matched controls, it was revealed that there was a marked deficit in the serum total proteins, alboumin, iron, haemoglobin (blood), retinol and zinc. Abnormally high serum copper levels among the cancer patients was also noticed. This data was in accordance with that of Mathur (1978).

This data suggests that the mean serum levels of minerals and vitamins are low in cancer patients due to lesser food intake but serum copper levels are high due to malignant tumors.

2. Body Weights :

The mean body weights of the cancer patients is presented in Table XVI. The individual body weights of the cancer patients is appended in Appendix-G.

TABLE - XVI

Mean Body Weights of Cancer Patients

S.No.	Typtes of Cancer	Mean Weights [Kg]	
		Male	Female
1.	Breast	--	60.6
2.	Cervix	--	55.0
3.	Oral	59.1	59.6
4.	Lymphoma	59.0	60.0
5.	Leukaemia	26.0	22.2
6.	Prostate	63.4	--
7.	Liver	64.0	--
8.	Pancreas	63.0	--
9.	Others	59.7	50.3
10.	Lung	62.7	46.0

TABLE - XVII

BLOOD GROUPS OF THE CANCER PATIENTS STUDIED

S.No.	Types of Cancer	Blood Groups								RH Factor			
		A		B		AB		O		Positive		Negative	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1.	Breast	6	2.8	6	2.8	3	1.4	17	8.0	27	12.8	5	2.4
2.	Cervix	3	1.4	5	2.4	7	3.3	34	16.1	43	20.4	6	2.8
3.	Oral	5	2.4	3	1.4	15	7.1	51	24.2	62	29.4	12	5.7
4.	Lymphoma	0	0	1	0.5	1	0.5	2	0.9	3	1.4	1	0.5
5.	Leukemia	2	0.9	1	0.5	2	0.9	1	0.5	5	2.4	1	0.5
6.	Genital Organs (prostate)	0	0	2	0.9	0	0	2	0.9	3	1.4	1	0.5
7.	Liver	0	0	0	0	2	0.9	1	0.5	2	0.9	1	0.5
8.	Pancreas	0	0	0	0	0	0	3	1.4	2	0.9	1	0.5
9.	Lung	0	0	1	0.5	2	0.9	2	0.9	4	1.9	1	0.5
10.	Others	1	0.5	1	0.5	5	2.4	24	11.4	20	9.5	11	5.2
	TOTAL	**17**	**8.0**	**20**	**9.5**	**37**	**17.5**	**137**	**64.9**	**171**	**81.0**	**40**	**19.1**

Comparison of the mean body weights of the cancer patients with the ideal body weights of Indian men and women that is 55 kg and 45 kg respectively, (ICMR, 1981) revealed that most of the female patients were overweight, except those suffering from lung cancer. In general all the male patients exceed the ideal body weight by 4 to 5 kg. In certain cases of oral and cervical cancers, severe emaciation and poor body weights were seen. Obsesity and overweight have been correlated with the increase in cancer risk especially those of colon, rectum, liver and breast (Newberne, 1975, Boutwell, 1983). But studies by Heymsfield et al (1987) report weight loss in oral, lung and cervical cancers and leukeamia. He also stated that the weight loss could be accounted for primarily by loss of fat and of striated muscle, and anorexia.

3. Blood Groups :

The blood groups of the surveyed cancer patients is presented in Table XVII.

Most of the patients (64.9 percent) belonged to the 'O' blood group while 17.5 percent, 9.5 percent and 8.0 percent belonged to AB, B and A blood groups respectively (81 percent were of Rh+ group) Studies by the Bombay cancer registry (1983) also reveal a greater cancer incidence among people belonging to the 'O' blood group.

E. Impact Evaluation of Soya Supplementation :

In order to find out the effect of soya protein on selected cervical cancer patients, eight patients were supplemented with 100g of defatted, high protein, deodorised soya flour daily, for a period

TABLE - XVIII

Impact Evaluation of Soya Supplementation

S.No.	Parameters (Mean)	Control Group				Experimental Group			
		Initial	Final	Difference	't' Value	Initial	Final	Difference	't' Value
	Serum Nutrients :								
1.	Total Protein (g/dl)	5.43	5.40	0.03	0.28 NS	5.05	6.19	-1.14	8.16 ++
2.	Albumin (g/dl)	3.43	3.40	0.03	1.289 NS	2.90	3.94	1.04	6.69 ++
3.	Globulin (g/dl)	2.0	2.0	0.0	0.0 NS	2.15	2.2	-0.05	0.44 NS
4.	Iron (mcg/dl)	77.99	77.98	0.01	0.003 NS	80.04	86.44	-6.4	5.96 ++
5.	Retinol (mcg/dl)	22.99	22.78	0.21	0.59 NS	21.99	27.71	-5.72	20.6 ++
6.	Copper (mcg/dl)	1.145	1.169	-0.024	0.09 NS	1.099	0.988	0.111	5.03 ++
7.	Zinc (mcg/dl)	0.524	0.506	0.018	1.25 NS	0.534	0.694	-0.160	8.43 ++
8.	Haemeglobin (Blood) (g/dl)	9.75	9.70	0.05	0.23 NS	9.99	10.83	-0.84	5.05 ++
9.	Body Weight (kg)	46.50	45.63	0.87	0.63 NS	45.25	46.81	-1.56	2.11 NS

NS - Not significant
++ - Significant at 1 percent

of three months. Four cervical cancer patients of the same age, body weight and stage of cancer served as the matched control. The impact evaluation of soya supplementation was studied in terms of serum concentrations of total protein, albumin, globulin, iron, retinol, copper, zinc and haemoglobin (blood) and body weight and radiation dosage.

Blood samples were drawn and body weights were measured before and after supplementation. The data obtained is presented in Table-XVIII. The individual serum nutrient levels and bodyweights before and after soya supplementation, are presented in Appendix H_1 to H_9.

1. Changes in Serum Nutrient Levels :

(a) Proteins :

A significant mean increase ($p < 0.01$) in serum total proteins, (1.149/dl) and albumin (1.049/dl) observed, while the mean increase in globulin (0.05 g/dl) was not significant, in the experimental group. No significant changes were observed in the control group. The significant mean increase in total proteins and albunim levels, may be attributed to the supplementation of soya proteins.

(b) Retinol :

The serum retinol levels exhibited a significant mean increase ($p < 0.01$), in the experimental group (5.72 mcg/dl), unlike the control group (0.21 mcg/dl). Supplementation with a good protein diet might have helped improve the retinol level.

(c) Iron and Haemoglobin :

A significant mean increase in serum iron and blood haemoglobin was observed at one per cent level, in the experimental group but not in the control group. Protein being a haemopoietic subtance could have had an impact on the improvement of this metabolite.

(d) Copper and Zinc :

A mean increase in serum zinc level was observed at one percent significance (8.43 mcg/dl) conversely, a signficant mean decrease in the serum copper level was observed in the experimental group. This is in accordance with the observations by Wallenius, and Abdulla, (1978) who stated that the blood levels of trace elements, like zinc, magnesium, copper and iron, normalised in those patients who responded to surgical, radiological, dietary and/or chemotherapeutic treatment.

2. Body Weight Changes :

A slight mean differnece was observed between the initial and final body weights, but to a greater extent in the experimental group than the control group.

3. Radiation Dosage :

There was no appreciable change in the radiation dosage, before and after supplementation. Fluctuations in the amount of radiation received by the patients was found to vary from 250 to 400 rads per day, during the course of the soya supplementation. Hence definite conclusions could not be drawn. May be a supplementation period of longer duration might help.

4. Observations by the Investigator :

Some of the nutritional problems associated with the presence of cancer were anorexia, with progressive weight loss and under nutrition, trauma, improper or imparied food intake, malnutrition (either overweight, obesity or under weight), pallor of skin (due to anaemia), taste changes causing depressed or altered food intake and general weakness, as observed by Shils (1986). Food aversion, that is dislike for a food or foods developed after exposure to that food or foods in association with unpleasant systemic reactions such as nausea or vomiting, was another major problem encountered. When soya supplementation was started, initially two patients experienced a feeling of nausea but later, incorporation of soya flour into the favourate food items of the patients, overcame the problem. A feeling of well-being was also observed among the patients.

From the favouring presentations and discussions, it may be concluded that a majority of the patients suffered from oral cancer (in males) and cervical cancer (in women). The number of non-vegetraians was far greater than that of vegetarians. Their food and nutrient intakes were inadequate when compared with the recommended daily allowance. This was reflected by the poor biochemical profile of the cancer patients. Dietary intake of protein, vitamin A, niacin and C, was found to be inadequate.

As severe emaciation, hypoalbuminuria and anemia were exhibited by cervical cancer patients, supplementation of the diets of selected patients with high protien, defatted, deodorised soya flour was undertaken for three months, the results of which were encouraging.

But long term studies are recommeneded for deriving conclusions with the decisive role of dietary supplements.

The role of diet in the treatment of cancer, has long been recognised, but has not yet been fully exploited. Among the problems encountered in the treatment of cancer patients, cachexia and trauma,, play a significant role. Hence further indepth studies on the epidemiology and dietary therapy of cancer may be undertaken.

Summary and Conclusion

CHAPTER - V

SUMMARY AND CONCLUSION

Cancer being the second commonest cause of death in the world, has been drawing the attention of epidemiologists and researchers, the world over. The role of diet as an important epidemiological factor, has been gaining ground. Hence the topic under study, namely, 'Epidemiological aspects and supplementation studies of selected cancer patients' was selected. Information on the associated epidemiological factors of the cancer patients was collected using a specially designed interview schedule. Their nutritional status was assessed by a three day - weighmen survey and biochemical estimations. Supplementation of the diets of selected cancer patients with soya flour was conducted for a period of three months, to determine the effect of an improved diet on the nutritional profiles of these patients.

The observations of the study are summarised as follows :

(1) The trend curve, drawn after data collection, from six hospitals in and around Coimbatore, indicates an increasing incidence of cancer.

(2) A survey of the case histories of 211 patients, in and around Coimbatore city, revealed the highest incidence of oral cancer (35 percent) followed by cervical cancer (24.2 percent) and breast cancer (15.2 percent).

(3) Women constituted the majority of the patients (52.1 percent). Out of which a sizable portion was contributed jointly by cervical and breast cancers (39.4 percent).

(4) The age group that was affected to the maximum, was between 41 to 50 years (35.5 percent). Leukaemia was found to be prevalent in children below 10 years (2.4 percent).

(5) Of the different religious groups, Hindus (79.6 percent) were found to be affected by cancer, when compared with Christians (11.4 percent) and Muslims (6.2 percent). Among the different communities, the highest incidence of cancer was found to be among the Tamilians (33.2 percent), followed by the Malayalees (10.4 percent).

(6) The highest incidence of cancer was found among patients drawing Rs. 501-1000 per month (19.4 percent), closely followed by those drawing Rs. 3001 and more per month (18.5 percent). The majority of the subjects were literate (68.2 percent), out of which 27 percent had collegiate education.

(7) Among the patients surveyed, 60.7 percent were employed. Out of the unemployed (39.3 percent), a major portion constituted housewives (32.7 percent).

(8) Nearly one-third of the patients (30.8 percent) had a family history of Diabetes, Hypertension and Ischemic heart disease.

(9) Thirty six percent of the cancer patients had a personal history of Diabetes (13.2 percent) and Hypertension (11.8 percent).

(10) Among breast and cervical cancer patients, the incidence of cancer was most prevalent in women whose menarchy started between the tenth and the twelth years (67 percent), who married between the nineteenth and twenti-first years, (38.7 percent), with the number of pregnancies ranging from three to four (36.7 percent) and where the menopausal age was between 45 to 50 years (61.7 percent). Most of the patients surveyed were married (80.1 percent). Consanguinity was exhibited by a small percentage of women (7.6 percent).

(11) The habitual use of tobacco, in the form of cigarettes, beedi, snuffpowder or betel quid (43.6 percent) and/or alcohol (36 percent) has been associated with the increasing occurance of oral cancer.

(12) The survey of the food consumption patterns of the patients revealed that 96.7 percent of the cancer patients consumed a rice-based diet. Majority of the patients consumed pulses and milk, but in inadequate amounts. The quantity and frequency of consumption of

protective foods namely, green leafy vegetables and fresh fruits was poor, especially among women.

(13) The nutrient intake of randomly selected cancer patients when compared with the RDA given by ICMR (1981) was significantly deficient, especially with regard to carotene and riboflavin.

(14) The plasma nutrient levels of the selected cancer patients when compared with that of normal individuals, revealed deficient serum levels of total proteins, aibumin, globulin, iron, zinc and retinol. Elevated serum copper level was also observed.

(15) Supplementation of the diets of selected cervical cancer patients with defatted, deodorised, high protien soya flour, coupled with nutrition education helped to augment their nutritional intake. This was reflected by a positive increase in the serum total proteins, albumin, iron, retinol and zinc levels and a decrease in serum copper level. A general sense of well being and mild improvement in body weights were also observed. But there was no significant change in the dosage of radiation therapy, as the period of supplementation was short (12 weeks).

In conclusion, it may be stated that nutritional factors play a significant role in the etiology of cancer. The use of dietary therapy in combination with other therapies like chemo therapy and radio therapy should also be given equal importance (Carroll, 1984).

The lines for further research may be listed as follows:

(1) The relationship between diet and serum immunoglobulin levels in cervical cancer.

(2) The study of anaemia as a prognostic factor in cervical cancer.

(3) The effect of diet upon the radiation response in cervical carcinoma.

(4) The role of a high-protien diet in the inhibition or enhancement of growth of malignant tumors; The early detection of preliminary lesions of the uterine cervix by PAP smear ie., (Cytological screening) and the study of the effect of dietary modifications on neoplastic growth and development.

(5) The effect of soya bean in altering the steriod excretion or steriod balance levels of cancer patients on a long term basis.

The cancer control strategies are concerned with primary prevention and early detection of cancer, cost effectiveness of approaches and health and nutrition education (Henderson et al, 1986). Cervical cancer has significant morbidity and mortality if it is not detected before it reaches an advanced stage with symptoms. If the disease is detected in an early asymptomatic stage it is nearly always curable by manipulation of certain environmental factors, such as dietary factors and the use of surgery and radiotherapy. Today,

cytological screening is the mainstay for control of cervical cancer (WHO, 1989).

Investigations have revealed that a significant proportion of the deaths from cancer could be prevented by dietary means and that dietary modifications would have the greatest effect on the incidence of cancers of the stomach and large bowel and, to a lesser extent, on cancers of the breast, endometrium, cervix and lung (Mc Leod, 1981). The weight of evidence suggests that what we eat during our lifetime strongly influences the probability of developing certain kinds of cancer but it is not possible to specify a diet that protects all people against all forms of cancer. Further epidemological and experimental research is likely to provide new insights into the relationship between diet and cancer.

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Appendix

APPENDIX A

INTERVIEW SCHEDULE

SURVEY FORM

Name : Place :

Address : Date :

Age :

Sex :

Nature of Ailment :

Religion :

Caste :

Occupation :

Income :

Literacy Status :

Family History :

Vegetarian/Non-Veg./Eggetarian :

Marital Status

(If women - Age of menarchy :

No. of days :

Age of menopause :

No. of children :

Consanguinity in marriage :

Personal History

Incidence of other diseases :

Hereditary disease :

Height :

Weight :

Blood group :

B.P. :

Hemoglobin : %

Type of Therapy :

I) MENU

No.	Break-fast	Lunch	Tea	Dinner
1.				
2.				
3.				

II. Food Consumption Details

Food	Qty.	Frequency of Consumption					
		Daily	Alternate Days	Weekly	Fort-nig-htly	Rarely	Nil (or)
1) CEREALS							
Rice (raw) (Parboiled)							
Wheat							
Ragi							
Maize							
Oatmeal							
Others							

Food	Qty.	Frequency of Consumption					
		Daily	Alternate Days	Weekly	Fort-nig-htly	Rarely	Nil (or)
2) Pulses							
Bengal Gram							
Black Gram Dal							
Greengram Dal							
Horsegram Dal							
Redgram Dal							
Rajmah							
Dried Pease							
Others							
3) Green Leafy Vegetables							
Agathi							
Amaranth							
Araikerai							
Cabbage							
Celery							
Colocasia Leaf							
Drumstick Leaf							
Others							
4) Other Vegetables							
Ash Gound							
Beans							
Bittergound							
Brinjal							
Cluster-beans							
Drumstick							
Lady's Finger							
Pumpkin							
Others							

Food	Qty.	Frequency of Consumption					
		Daily	Alternate Days	Weekly	Fort-nig-htly	Rarely	Nil (or)
5) Roots & Tubers							
Beet Root							
Carrot							
Colocasia							
Onion							
Potato							
Radish							
Sweetpotato							
Tapioca							
Yam							
Others							
6) Fruits							
Apple							
Banana							
Guava							
Lime							
Melon							
Orange							
Papaya							
Others							
7) Fleshy Foods							
Beef							
Chicken							
Mutton							
Pork							
Organ Meats							
Fish							
Egg							

Food	Qty.	Frequency of Consumption					
		Daily	Alternate Days	Weekly	Fort-nig-htly	Rarely	Nil (or)
8) Fats & Oils							
Butter							
Ghee							
Hydrogenated Oil							
Cooking Oil							
Groundnut Oil							
Sunflower Oil							
Palm Oil							
Gingelly Oil							
9) Milk & its Products							
Milk							
Cow							
Buffalo							
Skimmed							
Powered							
Condensed							
Buttermilk							
Curds							
Cheese							
10) Miscellaneous							
Biscuit							
Chutneys							
Pickles							
Pappads							
Sauces							
Squashes							
Canned Foods							

Food	Qty.	Frequency of Consumption					
		Daily	Alternate Days	Weekly	Fort-nig-htly	Rarely	Nil (or)
Snacks							
Sweets & Chocolates							
Savory							
Others							
11) Condiments & Spices							
Pepper							
Chillies							
Coconut							
Mustard							
Salt							
Cardamom							
Cinnamon							
Cloves							
Others							
12) Sugar & Jaggery							
Sugar							
Jaggery							
Honey							
Palm Sugar							
III) Alcohol Consumption							
Toddy							
Arrack							
Beer							
Rum							
Whiskey							
Gin							
Others							

Food	Qty.	Frequency of Consumption					
		Daily	Alternate Days	Weekly	Fort-nig-htly	Rarely	Nil (or)
IV) Smoking-Habits							
Cigarettes							
Cigar/Tobacco Chewing/Snuff Powder							
Beedi							
Betel Chewing							
V) Drugs							
Tranquilizers							
Antibiotics							
B-Complex							
Iron							
Others (Hashish, LSD, Ganja)							
VI) Type of Utensils Used for Cooking							
Copper							
Iron							
Steel							
Aluminium							
Clay (Mud Pots)							

VI) How often do you eat out ?

Places :

APPENDIX B

BIOCHEMICAL ESTIMATIONS

I Serum Protein Analysis

Estimation of Total Proteins : Using Ortho reagent

Testing Procedure

1. Pipette 4 ml of ortho total protein reagent into 3 tubes labelled test [T], standard [S] and Blank [B].

2. Dilute serum or plasma under test and orthoprotein standard [6g/dl] 1 to 20 with distilled water. Mix well and add 1 ml of each to the tubes T/and/S respectively. Add 1 ml of distilled water to tube B.

Alterntively : directly add 100 ml of each test sample, std and distilled water to tubes, T, S and B respectively to 5 ml ortho total protein reagent in each tube.

3. Mix the contents thoroughly at 37°C [preferably in a water bath for 15 mts.] [alternatively, at room temperature [25°C ± 5°C] for a few minutes.

4. Cool to room temperature and mix the contents.

5. Measure optical density (O.D) at 54 nm (range 530 nm to 560 nm). Set blank as calorimetric zero.

Calculation

$$\frac{\text{O.D. [T]}}{\text{O.D. [S]}} \times 6 = \text{Total protein concentration} \times T \text{ [g/dl]}$$

Total protein g/dl x 10 = g/l [S.I units]

Note : On storage if slight precipitate is observed, the reagent should be filtered and used. The reagent does not lose its sensitivity.

II. **Estimation of Albumin - Ortho Reagent**

Testing Procedure

1. Pipette 5.0 ml of ortho albumin reagents into 3 tubes labelled test [T], Standard [S] and Blank [B].
2. Dilute serum or plasma under test and working standard (i.e 4g/dl) 1 to 20 with distilled water, mix well and add 0.25 ml of each of the tubes T and S respectively. Add 0.25 ml of distilled water to tube B.

Alternatively : directly add 25 ml of each test sample, standard and distilled water to the tubes T, S, B respectively.

3. Mix the contents thoroughly and allow them to stand at room temperature (25 ± 5°C) for 10 minutes.
4. Measure optical density (O.D.) of each solution at 630 nm (range 620 nm - 640 nm) set blank as calorimetric zero.

Calculations

$$\frac{\text{O.D. [T]}}{\text{O.D [S]}} \times 4 = \text{Albumin concentrations T (g/dl)}$$

Albumin g/dl x 10 = g/l (S.I. units)

Working Standard : is 4 g/dl. Obtained by diluting 2 parts of ortho protein standard (6g/dl) with one part of 0.85 percent saline.

III. **Estimation of Haemoglobin by Cyanmethaemoglobin Method**

Principle

The haemoglobin treated with a reagent containing potassium ferricyanide, potassium dihydrogen phosphate. The ferricyanide forms methaemoglobin which is converted to cyanmethaemoglobin by the cyanide.

Reagents

Dvabkins diluent solution :

Sodium bicarbonate - 1 g

Potassium thiocyanide - 0.05 g

Potassium ferricyanide - 0.2 g

Distilled water - 1 lt.

The solution is preserved in a dark bottle and preferably under cold storage. Its preparation and handling should be done with great care. This solution should not be used after it forms a precipitate at the bottom of the storage bottle.

Procedure

1. Exactly 5.0 ml of the Drabkins diluent solution is measured into a dry test tube from a burette or a pipette with a suction bulb.
2. Exactly 0.02 ml of blood is transferred from a standard haemoglobin pipette into a diluent solution. Usual care in fitting and cleaning of loaded haemoglobin pipette must be observed.
3. The pipette is rinsed 3 times with the diluent solution without allowing the formation of air bubbles in the solution.
4. The blood and the diluent are thoroughly mixed by rotating the tube.
5. Ten minutes time is allowed for the formation of cyanmethaemoglobin.
6. 5.0 ml of diluent solution is used as blank.
7. The readings are taken in a photoelectric calorimeter at 540 m/l

IV. **Estimation of Iron by Wong's Method**

Principle

Iron is determined calorimetrically making use of the fact that ferric iron gives a blood red colour with potassium thiocynanate.

Reagents

1. 30 percent sulphuric acid
2. 7 percent potassium per sulphate solution : is dissolved in glass distilled water and the solution is made upto 150 ml.

3. 40 percent potassium thiocyanate solution : 40 g of KCNS is dissolved in 90 ml glass distilled water. 4 ml acetone added and the volume made upto 100 ml.

4. Standard iron solution : 2.2 mg ferrious ammonium sulphate is dissolved in 100 ml glass distilled water and after addition of 5 ml of 1 : 1 hydrochloric acid, the solution is made upto 1 lt. is mixed thoroughly (0.1 mg iron/ml). The standard solution is prepared fresh once in 6 months.

5. Working standard solution : (10 mg iron/ml) is prepared by diluting the above solution 10 fold.

Procedure

Two ml of concentrated sulphuric acid is taken in a 50 ml volumetric flask. Add exactly 0.5 ml of well mixed blood, mix and to this add 2 ml of potassium per sulphate, agitate the flask, cool and dilute with about 25 ml distilled water. Then add 2 ml of sodium tungstate and the volume is made upto the mark. Filter using whatman No. 42 filter paper. Transfer 15 ml of the filtrate to a fresh tube, add 1.0 ml persulphate and 4.0 ml of potassium thiocynate. Mix and read the colour at 540 nm in a calorimeter. A standard (10 - 100 mcg) is run similarly and a standard graph is prepared.

Calculation

g Haemoglobin = 0.3 x mg Iron

V. Estimation of Serum Trace Elements - Zinc and Copper

Principle

Serum on digestion with triple acid, nitric acid, sulphuric acid and phosphoric acid in the ratio of 9 : 2 : 1 liberates into solution the trace elements.

Procedure

1.0 ml of serum sample was taken in a microkjeldahl digestion flask which was previously washed with glass distilled water and dried and to this was added 10 ml of triple acid. The mixture was shaken and digested in a sand bath with occassional shaking. The digestion was continued till no brown fumes evolved and the solution in the flask becomes colourless. The digested mixture was transferred to a 25 ml standard flask, the washing being done with double distilled water. This solution was used for analysing the trace elements, using the atomic absorption spectrophotometer (AA 120 mode)

Procedure for Routine Analysis

Selected lamps to be used and inserted them in lamp quadrante.

2. Depressed the relevant lamp; select button for the lamp being used and set the water select to the same lamp.
3. Switched on the instrument, set the lamp at the desired current and allowed to stabilise for 10-15 minutes.

4. Set indicator unit in the transmission mode with the select switch 'normal'.

5. Set the monochromator to the wavelength required with the relevant split opening and using again setting to give approximately 80 percent reading.

6. Selected the desired mode of operation on the indicator unit (i.e.) absorbance or transmission.

7. Selected the "Auto 100" mode and trimmed the "set 100". Read 0.0 absorbance or 100 percent transmission.

8. Lighted the flame.

9. Nebulised the sample into the flame.

VI. **Estimation of Serum Retinol**

Principle

The absorption of 460 nm and the difference in absorption at 326 nm before and after irradiation with UV light (between wavelengths 310 - 400 nm) can be used as a measure of carotene and vitamin A respectively.

Reagents

25 percent alcoholic potassiumhydroxide : 1N potassium hydroxide in 90 percent ethanol is prepared fresh and used for saponification.

Procedure

Extraction and Saponification

In a glass stoppered tube 3-4 ml of serum and an equal volume of alcoholic potassium hydroxide are taken and mixed well. The tube is incubated in a waterbath at 60-65°C for 20 minutes removed and allowed to cool to room temperature. The unsaponifiable matter is then extracted 3 times with 10 ml of light petroleum ether. After the first extraction, the aqueous phase should be diluted further with water to ensure complete extraction. The petroleum ether extract is washed with water to remove the alkalis, passed through anhydrous sodium sulphate and evaporated to dryness under vacuum at 40°C. The dry residue is immediately dissolved in 3-4 ml cyclohexane (same volume as serum).

The O.D. of the cyclohexane solution is measured at 328 nm and at 460 nm in a spectrophotometer. The solution is now transferred to a soft glass tube with a stopper and irradiated with UV light. The lamp should be turned on 10 minutes before use. The tube should be kept at a distance of 20 cm from the lamp. The O.D. at 328 nm is again read and the difference in O.D. is taken as a measure of Vitamin A in the solution.

Calculation

$$E^{1\%}_{1cm}\ 328 \text{ of Vitamin A in cyclohexane} = 1550$$

and

$$E^{1\%}_{1\ cm}\ \text{for B carotene} = 2100$$

mcg/of Vitamin A/100 ml serum = [E 328 initial - E 328 irradiated]

mcg/of B - Carotene in 100 ml serum] = E 460 x 477

Note : This method can be scaled down to 1 ml serum also, provided microcuvette for the spectrophotometer are used to read a small volume of cyclohexane extract.

APPENDIX C

Frequency of Food Consumption

No.	Foods	Frequency												Average Amount (g)
		Daily		Alternately		Weekly		Fortnightly		Rarely		Never		
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
1.	Cereals													
	Rice	160	75.8	42	19.9	2	0.9	0	0	0	0	7	3.3	151.8
	Wheat	48	22.7	19	9.0	11	5.2	8	3.8	4	1.9	121	57.3	62.4
	Ragi	32	15.2	13	6.2	7	3.3	3	1.4	11	5.2	145	68.7	53.9
	Maize	5	2.4	1	0.5	5	2.4	5	2.4	3	1.4	192	91	45.3
	Oats	7	3.3	1	0.5	0	0	2	0.9	3	1.4	198	94	27.4
	Others	27	12.8	25	11.9	12	5.7	14	6.6	4	1.9	129	61.1	55.8
2.	Pulses													
	Redgram	130	61.6	26	12.3	22	10.4	4	1.9	4	1.9	25	11.9	24.3
	Bengalgram	7	3.3	12	5.7	9	4.3	4	1.9	0	0	179	84.9	25.6
	Greengram	3	1.4	20	9.5	16	7.6	6	2.8	0	0	166	78.7	21.9
	Blackgram	5	2.4	6	2.8	9	4.3	2	0.9	0	0	189	89.6	27.7
	Peas	3	1.4	3	1.4	6	2.8	4	1.9	0	0	195	92.4	27.8
	Rajmah	3	1.4	6	2.8	3	1.4	2	0.7	1	0.5	196	92.9	34.3
	Others	2	0.9	2	0.9	2	0.9	0	0	1	0.5	204	92.9	45.7
3	Green leafy Vegetables													
	Amaranth	26	12.3	29	13.7	17	8.1	13	6.2	4	1.9	122	57.8	12.4
	Agathi	13	6.2	31	14.7	9	4.3	14	6.6	1	0.5	143	67.8	13.8
	Araikeerai	7	3.3	14	6.6	14	6.6	13	6.2	2	0.9	161	76.3	10.2
	Cabbage	8	4.2	25	11.8	33	15.6	15	7.1	2	0.9	128	60.6	13.0
	Drumstick Leaves	2	0.9	7	3.3	10	4.7	6	2.8	0	0	186	88.2	11.2
	Others	10	4.7	3	1.4	9	4.3	1	0.5	3	1.4	185	87.7	15.7
4	Other Vegetables													
	Beans	37	17.5	79	37.4	39	18.5	4	1.9	1	0.5	51	24	18.0
	Gourd	8	4.2	29	13.5	26	12.3	3	1.4	0	0	145	68.7	18.3

No.	Foods	Frequency												Average Amount (g)
		Daily		Alternately		Weekly		Fortnightly		Rarely		Never		
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
	Drumstick	22	10.4	44	20.9	42	19.9	4	1.9	2	0.9	97	46	16.3
	Ladies finger	32	15.1	49	23.3	39	18.5	18	8.5	11	5.2	62	29.4	20.1
	Pumpkin	13	6.2	29	13.5	8	4.2	24	11.4	2	0.9	135	64	14.9
	Brinjal	11	5.2	19	9.0	18	8.5	0	0	0	0	163	77.3	14.6
	Others	2	0.9	7	3.3	2	0.9	0	0	3	1.4	197	93.4	15.2
5.	Roots & Tubers													
	Beet root	5	2.4	23	10.9	34	16.1	6	2.8	3	1.4	140	66.4	16.6
	Carrot	24	11.4	52	24.6	62	29.4	10	4.7	8	3.8	55	26.1	19.4
	Onion	124	58.8	37	17.5	11	5.2	3	1.4	1	0.5	35	16.6	13.8
	Potato	51	24.2	89	42.2	24	11.4	10	4.7	2	0.9	35	16.6	24.7
	Radish	6	2.8	18	8.5	7	3.3	4	1.9	2	0-.9	174	82.5	24.7
	Tapioca	4	1.9	28	13.3	12	5.7	1	0.5	6	2.8	160	75.8	3.1
	Yam	4	1.9	18	8.5	18	8.5	2	0.9	5	2.4	164	7.77	20.1
	Others	0	0	10	4.7	6	2.8	0	0	4	1.9	191	90.5	23.5
6.	Fruits													
	Apple	17	8.1	19	9	22	10.4	4	1.9	10	4.7	139	65.9	24.9
	Orange	1	0.5	8	3.8	16	7.6	4	1.9	2	0.9	180	85.3	22.3
	Banana	19	9	34	16.1	37	17.5	19	9	9	4.3	93	44.1	20.9
	Guava	3	1.4	9	4.3	15	7.1	17	8.1	8	3.8	159	75.3	23.5
	Lime	25	11.8	42	19.9	24	11.4	12	5.7	8	3.8	100	47.4	7.6
	Papaya	3	1.4	7	3.3	13	6.2	5	2.4	5	2.4	178	84.4	20.2
	Others	9	4.3	24	11.4	7	3.3	0	0	1	0.5	170	80.6	29.3
7.	Fleshy Foods													
	Mutton/beef	24	11.4	42	19.9	79	37.4	8	3.8	10	4.7	48	22.7	50.4
	Chicken	8	3.8	33	15.6	40	19	3	1.4	9	4.3	118	55.9	40.2
	Fish	6	2.8	24	11.4	45	21.3	15	7.1	13	6.2	108	51.2	27.6

No.	Foods	Frequency												Average Amount (g)
		Daily		Alternately		Weekly		Fortnightly		Rarely		Never		
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
	Egg	24	11.4	43	20.3	63	29.9	19	9.0	11	5.2	51	24.2	43.1
	Others	1	0.5	4	1.9	3	1.4	4	1.9	8	3.8	191	90.5	37.3
8.	Fats & Oils													
	Butter	27	12.8	14	6.6	5	2.4	5	2.4	10	4.7	150	71.1	7.4
	Ghee	15	7.1	11	5.2	7	3.3	2	0.9	6	2.8	170	80.6	9.2
	Coconut oil	11	5.2	13	6.2	8	3.8	3	1.4	3	1.4	173	82	23.1
	Palm Oil	174	82.5	21	10	8	3.8	1	0.5	0	0	7	3.2	20
	Gingelly oil	12	5.7	10	4.7	8	3.8	4	1.9	0	0	177	83.9	24.7
	Groundnut oil	2	0.9	1	0.5	1	0.5	0	0	0	0	207	98.1	15.8
9.	Milk & Milk products													
	Milk (cow)	189	89.6	7	3.3	1	0.5	0	0	1	0.5	13	6.2	52.6
	Buttermilk	67	31.8	40	18.9	6	2.8	0	0	2	0.9	96	45.5	24.4
	Curds	32	15.2	53	25.1	19	9	4	1.9	7	3.3	96	45.5	24.9
	Cheese	3.0	1.4	2	0.9	4	1.9	5	2.4	2	0.9	195	92.4	11.0
10.	Miscellaneous													
	Biscuits	28	13.3	44	20.9	32	15.2	4	1.9	5	2.4	98	46.4	19.3
	Chutney	12	5.7	14	6.6	4	1.9	0	0	2	0.9	179	84.8	9.0
	Pickles	41	19.4	39	18.5	10	4.7	6	2.8	6.0	2.8	109	51.7	6.0
	Pappads	28	13.3	25	11.8	17	8.0	9	4.3	3	1.4	129	61.1	6.8
	Sweets	17	8.1	23	10.9	50	23.7	8	3.8	13	6.2	100	47.4	24.5
	Savory	8	3.8	13	6.2	23	10.9	3	1.4	7	3.2	157	74.4	22.0
11.	Condiments & Spices													
	Chillies	107	50.7	3	1.4	3	1.4	2	0.9	2	0.9	94	44.5	3.8
	Pepper	13	6.2	6	2.8	4	1.9	1	0.5	1	0.5	186	88.2	1.5
	Coconut	39	18.5	22	10.4	12	5.7	0	0	1	0.5	137	64.9	5.6

No.	Foods	Frequency												Average Amount (g)
		Daily		Alternately		Weekly		Fortnightly		Rarely		Never		
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
	Salt	188	89	5	2.4	1	0.5	0	0	0	0	17	8.1	3.9
	Cardomen	3	1.4	1	0.5	9	4.3	2	0.9	16	7.6	180	85.3	4.2
	Others	6	2.8	1	0.5	7	3.2	2	0.9	15	7.1	180	85.3	4.7
12.	Sugar													
	Sugar	200	94.8	2	0.9	1	0.5	1	0.5	0	0	7	3.3	22.3
	Jaggery	63	29.9	21	9.9	13	6.2	3	1.4	101	47	10	4.7	15.9

APPENDIX D_1

Mean Food Intake (Men)

S.No.	Cereal g	Pulse g	Green leafy vegetable g	Other vegetables g	Roots and tubes g	Milk and its products g	Fats and oils g	Sugar and jaggery g	Fruits g
1.	341.6	60.4	8.3	5.0	15.0	122.6	6.6	21.0	21.7
2.	397.1	17.7	2.0	5.0	18.4	45.0	35.3	16.7	0
3.	311.6	31.7	0	4.7	15.3	100.0	20.3	32.0	4.3
4.	517.4	9.0	5.0	16.6	11.3	45.7	23.3	14.7	7.3
5.	461.7	6.7	2.0	0	18.6	136.6	27.0	27.6	31.7
6.	304.4	15.4	2.7	5.6	57.5	20.0	27.0	22.0	0
Total	**2333.8**	**140.9**	**20**	**36.9**	**136.1**	**469.9**	**139.5**	**134**	**65**

APPENDIX D_2

Mean Food Intake (Women)

S.No.	Cereal g	Pulse g	Green leafy vegetable g	Other vegetables g	Roots and tubes g	Milk and its products g	Fats and oils g	Sugar and jaggery g	Fruits g
1.	476.6	50.0	9.0	12.0	26.1	25.0	20.0	28.0	1.0
2.	425.0	43.3	9.0	8.7	28.7	55.0	23.0	23.3	12.3
3.	322.3	15.0	12.7	5.9	65.1	34.4	29.4	24.0	28.0
4.	426.7	7.7	1.7	7.6	28.3	40.0	33.6	24.0	3.3
5.	339.0	12.0	0	28.4	23.7	50.7	16.0	30.0	20.7
6.	236.6	6.7	6.7	24.0	12.3	66.6	17.4	22.7	27.3
7.	366.0	20.0	2.0	16.3	68.4	50.0	28.7	20.0	26.7
8.	399.7	46.7	18.3	11.4	31.7	41.0	25.3	20.0	30.0
9.	245.3	74.4	2.0	17.6	43.0	42.4	22.3	20.0	24.3
10.	386.6	3.3	12.7	4.0	24.6	37.3	25.3	26.7	35.7
11.	306.7	18.3	11.7	5.7	67.0	30.0	21.7	27.0	21.3
12.	290.1	0	3.3	8.3	0	6.7	9.3	24.7	12.0
13.	347.9	52.0	0	4.0	21.0	41.3	24.7	33.0	13.7
14.	406.7	0	15.0	4.6	26.7	61.7	21.7	23.3	6.7
Total	**4885.2**	**349.4**	**104.1**	**158.5**	**466.6**	**582.1**	**318.4**	**339.4**	**263**

APPENDIX E_1

Mean Nutrient Intake (Men)

S.No.	Energy K calories	Protein g	Fat g	Fibre g	Calcium mg	Iron mg	Carotene mcg	Thiamine mg	Ribo-flavin mg	Niacin mg	Vitamin C mg
1.	1518	35.2	16.81	2.04	274	16.6	1146	0.82	0.48	11.1	16
2	1768	33.6	40.00	2.10	106	21.4	74	0.93	0.35	14.3	5
3.	1531	33.4	38.20	2.23	193	11.6	655	1.03	0.43	9.1	5
4.	1728	31.1	26.90	2.00	166	19.6	357	0.96	0.33	15.3	8
5.	2151	46.2	40.11	3.47	312	21.6	721	1.32	0.63	16.0	9
6.	1512	25.0	31.20	4.04	390	15.4	74	0.92	0.36	10.4	16

APPENDIX E_2

Mean Nutrient Intake (Women)

S.No.	Energy K calories	Protein g	Fat g	Fibre g	Calcium mg	Iron mg	Carotene mcg	Thiamine mg	Ribo-flavin mg	Niacin mg	Vitamin C mg
1.	2040	43.4	26.80	3.57	463	21.8	483	1.13	0.37	15.4	30
2.	1987	42.4	29.70	2.37	194	24.1	260	1.13	0.41	15.8	23
3.	1625	38.0	36.50	4.38	241	27.4	1302	1.25	0.44	14.6	43
4.	1928	34.3	34.30	1.87	312	16.8	54	0.79	0.44	14.6	5
5.	1520	34.1	23.84	3.18	144	17.9	129	0.82	0.63	12.3	44
6.	1184	22.0	32.39	3.18	322	12.1	626	0.67	0.31	8.0	23
7.	1945	38.6	44.34	2.30	167	14.6	296	0.85	0.29	12.1	22
8.	1712	35.7	28.60	1.93	233	21.8	965	0.90	0.45	13.3	49
9.	1448	37.1	29.70	2.90	308	2.9	183	1.22	0.42	10.0	18
10.	1692	30.0	29.00	4.44	435	16.0	474	0.94	0.34	10.9	45
11.	2065	28.4	25.40	3.05	340	15.8	555	0.93	1.25	10.7	28
12.	1182	21.4	11.80	3.20	598	12.0	52	0.48	0.28	5.2	2
13.	1828	40.7	39.20	4.58	466	14.4	494	1.34	0.50	9.7	1
14.	1699	31.2	27.28	9.98	1015	23.3	764	1.18	0.67	6.2	26

APPENDIX F_1

Individual Serum Nutrient Levels of Control Group

S.No.	Total Protein g/dl	Albumin g/dl	Globulin g/dl	A : G Ratio	Haemoglobin g/dl	Iron mcg/dl	Retinol mcg/dl	Copper mcg/dl	Zinc mcg/dl
1.	6.5	4.2	2.3	1.8:1	13.6	108.80	41.28	0.830	0.940
2.	8.0	5.0	3.0	1.7:1	14.0	110.60	50.00	0.805	0.820
3.	6.8	4.6	2.2	2.1:1	13.0	105.30	44.86	0.950	1.120
4.	6.2	4.2	2.0	2.1:1	13.2	105.60	43.66	0.970	1.025
5.	7.0	4.1	2.9	1.4:1	13.8	109.02	48.50	0.812	0.880
6.	7.5	5.0	2.5	2.0:1	13.2	105.60	49.25	0.889	0.905
7.	6.9	4.2	2.7	1.6:1	13.0	105.30	47.20	0.990	1.052
8.	7.0	4.5	2.5	1.8:1	13.5	108.00	47.10	0.872	1.000
9.	7.3	4.3	3.0	1.5:1	12.2	99.06	50.05	0.891	0.900
10.	8.1	5.5	2.6	2.1:1	13.8	110.40	51.60	0.895	0.830

APPENDIX F_2

Individual Serum Nutrient Levels of Selected Cancer Patients

S.No.	Total Protein g/dl	Albumin g/dl	Globulin g/dl	A : G Ratio	Haemoglobin g/dl	Iron mcg/dl	Retinol mcg/dl	Copper mcg/dl	Zinc mcg/dl
1.	5.8	4.0	1.8	2.2:1	11.0	89.32	20.84	1.063	0.426
2.	4.1	2.1	2.0	1.1:1	8.8	69.52	23.00	1.020	0.511
3.	5.2	3.0	2.2	1.4:1	9.8	78.40	23.22	1.000	0.513
4.	5.6	3.2	2.4	1.3:1	11.7	92.43	24.05	1.252	0.528
5.	4.8	2.9	1.9	1.5:1	8.6	69.66	19.95	1.155	0.620
6.	5.2	3.2	2.0	1.6:1	10.2	81.60	23.15	1.160	0.695
7.	4.3	2.4	1.9	1.3:1	9.5	16.95	20.00	0.990	0.500
8.	5.4	2.4	3.0	0.8:1	10.3	82.40	21.77	1.150	0.480
9.	4.6	2.8	1.8	1.5:1	8.7	69.60	22.00	1.300	0.420
10.	5.9	3.9	2.0	2.0:1	9.9	78.21	21.63	1.000	0.310
11.	5.1	2.7	2.4	1.1:1	9.5	76.95	23.36	1.130	0.625
12.	6.1	4.3	1.8	2.4:1	10.9	87.20	25.00	1.150	0.740
13.	5.3	3.8	1.5	2.5:1	9.3	74.40	22.54	0.992	0.479
14.	5.2	3.7	1.5	2.4:1	9.7	78.57	24.61	1.350	0.382
15.	5.5	3.8	1.7	2.2:1	10.2	81.60	19.30	1.420	0.485
16.	5.8	4.1	1.7	2.4:1	10.4	84.24	28.45	0.900	0.923
17.	5.2	3.4	1.8	1.8:1	9.78	78.57	20.64	1.070	0.781
18.	4.9	2.7	2.2	1.2:1	10.8	85.08	20.01	0.890	0.622
19.	5.8	3.2	2.6	1.2:1	10.1	79.70	25.50	0.988	0.633
20.	6.1	4.0	2.1	1.9:1	11.7	93.60	19.80	1.225	0.555

APPENDIX G

Individual Body Weights of Patients [Kg]

Breast	Cervix	Oral		Lung		Lymphoma		Leukemia	Prostate		Liver		Pancreas		Others	
F	F	M	F	M	F	M	F	M	F	M	M	F	M	F	M	F
58	73	55	67	65	48	66	60	26	31	54	72	0	69		63	40
60	59	53	60	72	44	52			20	63	55		62		57	46
69	47	52	58	50					20	61	65		58		49.5	60
48.5	47	63	47	49					22	67					63	48
67	59	49	63	61					18	72					48	58
64	68	63	49	79											77	
63	59	63	66												63	
45	56	56	53												60	
87	58	53	54												49	
63	58	59	51.5												40	
54	57	64	87												58	
68	58	37.5													58.5	
68	65	53													68	
62	60	49													57.5	
83	64.5	52													68	
58	59	50													62	
70	53	52													58	
59	58	84													43	

Individual Body Weights of Patients [Kg]

Breast	Cervix	Oral		Lung		Lymphoma		Leukemia		Prostate	Liver		Pancreas		Others	
F	F	M	F	M	F	M	F	M	F	M	M	F	M	F	M	F
53	52	44													64	
57.5	36	53.5													60	
63	42	58													66	
42	38	60													62	
66	59	56													80	
63	38	63													57	
52	45	60														
49	42	63.5														
62	68	49														
54	54	54														
55	45	63														
	48	53														
	56	72														
	51	82														
	61	62														
	58	64														
	50	69														
	70	70														
	59	59														

Individual Body Weights of Patients [Kg]

Breast	Cervix	Oral		Lung		Lymphoma		Leukemia		Prostate	Liver		Pancreas		Others	
F	F	M	F	M	F	M	F	M	F	M	M	F	M	F	M	F
	58	60														
	58.5	92														
	65	59														
	61	48														
	46	52														
	57	48														
	62	59.5														
	56	58.5														
	63	71.5														
	47	62														
	45	48														
	63	83														
	50	49														
	42	68														
	38	58														
	49															
	77															
	58															
	62															
	68															

APPENDIX H

Individual Serum Nutrient Level and Body Weights Before and After Supplementation

H_9 Body Weights (kg)

S.No.	Initial	Final	Difference
Experimental Group			
1.	52.0	52.5	-0.5
2.	36.0	39.0	-3.0
3.	42.0	44.5	-2.5
4.	38.0	41.5	-3.5
5.	59.0	57.0	+2.0
6.	48.0	47.5	+0.5
7.	45.0	46.5	-1.5
8.	42.0	46.0	-4.0
Control Group			
1.	39.0	40.0	-1.0
2.	54.0	54.0	0
3.	45.0	45.5	-0.5
4.	48.0	43.0	+5.0

APPENDIX H_1

S.No.	Serum Total Protein Levels (g/dl)		
	Initial	Final	Difference
Experimental Group			
1.	5.8	6.3	-0.5
2.	4.1	5.7	-1.6
3.	5.2	6.2	-1.0
4.	5.6	1.0	-1.4
5.	4.8	6.0	-1.2
6.	5.2	5.8	-0.6
7.	4.3	5.8	-1.5
8.	5.4	6.7	-1.3
Control Group			
1.	4.6	4.8	-0.2
2.	5.9	5.7	+0.2
3.	5.1	5.0	+0.1
4.	6.1	6.1	0

APPENDIX H_2

S.No.	Serum Albumin Levels (g/dl)		
	Initial	Final	Difference
Experimental Group			
1.	4.0	4.3	-0.3
2.	2.1	3.6	-1.5
3.	3.0	4.0	-1.0
4.	3.2	4.4	-1.2
5.	2.9	3.9	-1.0
6.	3.2	3.7	-0.5
7.	2.4	3.6	-1.2
8.	2.4	4.0	-1.6
Control Group			
1.	2.8	3.0	-0.2
2.	3.9	3.7	+0.2
3.	2.7	2.7	0
4.	4.3	4.2	+0.1

APPENDIX H_3

S.No.	Serum Globulin (g/dl)		
	Initial	Final	Difference
Experimental Group			
1.	1.8	2.0	-0.2
2.	2.0	2.1	-0.1
3.	2.2	2.2	0
4.	2.4	2.6	-0.2
5.	1.9	2.1	-0.2
6.	2.0	2.1	-0.1
7.	1.9	2.2	-0.3
8.	3.0	2.3	+0.7
Control Group			
1.	1.8	1.8	0
2.	2.0	2.0	0
3.	2.4	2.3	+0.1
4.	1.8	1.9	-0.1

APPENDIX H_4

S.No.	Blood Haemoglobin Levels (g/dl)		
	Initial	Final	Difference
Experimental Group			
1.	11.0	11.9	-0.9
2.	8.8	9.0	-0.2
3.	9.8	11.3	-1.5
4.	11.7	12.0	-0.3
5.	8.6	9.7	-1.1
6.	10.2	10.7	-0.5
7.	9.5	10.8	-1.3
8.	10.3	11.2	-0.9
Control Group			
1.	8.7	9.2	-0.5
2.	9.9	10.00	-0.1
3.	9.5	9.2	+0.3
4.	10.9	10.4	+0.5

APPENDIX H_5

S.No.	Blood (Plasma) Iron Levels (mg/dl)		
	Initial	Final	Difference
Experimental Group			
1.	89.32	94.00	-4.68
2.	69.52	72.90	-3.38
3.	78.40	90.40	-12.00
4.	92.43	97.20	-4.77
5.	69.66	77.60	-7.94
6.	81.60	84.53	-2.93
7.	76.95	85.32	-8.37
8.	82.40	89.40	-7.20
Control Group			
1.	69.60	74.52	-4.92
2.	78.21	81.00	-12.79
3.	76.95	72.59	+4.36
4.	87.20	83.82	+3.38

APPENDIX H_6

S.No.	Serum Retinol Levels (mcg/dl)		
	Inital	Final	Difference
Experimental Group			
1.	20.84	26.34	-5.5
2.	23.00	27.80	-4.8
3.	23.22	28.02	-4.8
4.	24.05	30.30	-6.25
5.	19.95	26.25	-6.3
6.	23.15	28.15	-5.0
7.	20.00	26.20	-6.2
8.	21.77	28.62	-6.85
Control Group			
1.	22.00	21.65	+0.35
2.	21.63	21.50	+0.13
3.	23.36	24 07	-0.71
4.	25.00	23.88	+1.12

APPENDIX H_7

S.No.	Serum Copper Levels (mcg/dl)		
	Initial	Final	Difference
Experimental Group			
1.	1.063	0.877	+0.186
2.	1.020	1.000	+0.02
3.	1.000	0.980	+0.02
4.	1.252	1.113	+0.139
5.	1.155	1.045	+0.11
6.	1.160	0.988	+0.172
7.	0.990	0.874	+0.116
8.	1.150	1.030	+0.12
Control Group			
1.	1.300	1.335	-0.035
2.	1.000	0.989	+0.011
3.	1.130	1.129	+0.001
4.	1.150	1.224	-0.074

APPENDIX H_8

S.No.	Serum Zinc Levels (mcg/dl)		
	Initial	Final	Difference
Experimental Group			
1.	0.426	0.621	-0.195
2.	0.511	0.695	-0.184
3.	0.513	0.704	-0.191
4.	0.528	0.765	-0.237
5.	0.620	0.756	-0.136
6.	0.695	0.808	-0.113
7.	0.500	0.612	-0.112
8.	0.480	0.587	-0.107
Control Group			
1.	0.420	0.436	-0.016
2.	0.310	0.277	+0.033
3.	0.625	0.620	+0.005
4.	0.740	0.692	+0.048

APPENDIX - J

PROCEDURES FOR THE PREPARATION OF SOYA RECIPES

(1) Soya - Dahi - Pakodas :

Ingredients :

Soyabeans	- 500 g
Gramflour	- 150 g
Chillipowder	- 1 tsp
Soyasauce	- 1½ tsp
Corianderpowder	- 1½ tsp
Turmericpowder	- a pinch
Seedless dates	- 100 g
Tamarind	- 50 g
Jaggery powder	- 75 g
Curd	- 500 g
Coriander leaves	
Cumin powder	
Black Pepperpowder	
Sugar	
salt	- to taste

Procedure :

Soak soyabean for atleast 12 hours. Grind to a fine paste in a mixer. Grind gram flour, chilli powder, soyasauce coriander powder, turmeric powder and salt also. Deep fry small balls till the pakodas are light brown in colour. Drain and cool. Whip the curd

and add sugar to taste. Add all the pakoda and keep in the fridge for about an hour.

For the Chutney :

Mix together jaggery, date and tamarind in a mixer. Add this chutney to the pakodas in curd and decorate with mint leaves, cumin powder and pepper powder, serve cold.

2. Soya Idly :

Ingredients :

Soyabean dhal	- 50 g
Rice	- 100 g
Urad dhal	- 50 g
Salt	- to taste

Methods :

(1) Clean and soak rice, soak urad dhal and soyabean separately for 6 hours.

(2) Grind rice coarse and urad dhal and soyabean fine.

(3) Mix all three well, add enough water to make a thick batter.

(4) Add salt and leave overnight.

3. Soya dosai :

(Similar to the procedure for soya idli)

4. Soya Rice Roti :

Ingredients :

Soya flour	- 100 g
Rice flour	- 100 g

Cumin powder	-	1 tsp
Chopped green chillies	-	1 tsp
Chopped onions	-	2
Scraped fresh coconut	-	2 Tbsp.
Chopped corianderleaves	-	1 Tbsp
Salt	-	to taste
Water	-	1/3 C
Vegetable fat or oil	-	enough for shallow frying

Method :

(1) Mix soya flour, rice flour, cumin powder, salt, chopped onions, chillies, coriander leaves and coconut.

(2) Add water little by little and make a stiff dough and divide dough into eight equal parts.

(3) Take each part and flatten it on a clean wet cloth. Shallow fly on a hot greased tawa, brown on either side, serve with coconut chutney.

5. Soya Halwa :

Ingredients :

Soya flour	-	50 g
Wheat flour	-	50 g
Vegetable fat	-	75 g
Sugar	-	75 g
Garnish	-	20 g

Method :

(1) Fry wheat flour and soya flour separately in fat.

(2) Mix the fried flours with sugar and fry a little more with the rest of the fat.

(3) Add ¼ C of water and cook for 5 to 10 minutes and remove from fire.

(4) Decorate it with scraped coconut and raisins and serve.

6. Soya Dal Curry :

Ingredients :

Soya dal	-	50 g	
Hot water	-	4 C	
Medium tomatoes	-	2	
Chopped coriander leaves	-	1 Tbsp	
Mustard seeds	-	¼ tsp	Fry and powder
Fenugreek seeds	-	1/8 tsp	
Coriander seeds	-	2 tsp	
Jeera	-	¼ tsp	
Black pepper	-	1/8 tsp	
Dried chillies	-	5	
Asafoetida	-	a pinch	
Salt - according to taste			
Scraped coconut	-	2 Tsps (optional)	
Mustard seeds	-	½ tsp	
Fat	-	1 tsp for seasoning.	

Method :

(1) Soak soyadhal overnight.

(2) Cook in a pressure cooker for 15 minutes under 15 lbs pressure.

(3) Add fried and powdered spices, salt and cut tomatoes.

(4) Boil till tomatoes become tender.

(5) Remove from fire, add chopped corinder leaves and scraped coconut.

(6) Season with fat and mustard seeds.

(7) Serve with rice.

7. Soya Chappathi :

Ingredients :

Soya flour	-	50 g
Wheat flour	-	150 g
Water	-	1/2 C

Method :

(1) Mix both flours, and water gradually and make a soft dough.

(2) Knead for 10 minutes.

(3) Roll into chappathis and cook on hot tawa.

(4) Remove from tawa after puffing.

(5) Store in covered pan until serving.

Note : to prepare Methi roti, add 25g of chopped greens or drumstick leaves, while preparing the dough.

8. Soya Chutney :

Ingredients :

Processed soyabean	-	25g
Scraped coconut	-	100g
Black gram dhal	-	1 Tbsp
Heeng	-	a pinch
Mustard seeds	-	1 tsp
Green chillies	-	4
Curry leaves	-	a few
Tamarind and salt	-	according to taste

Method :

(1) Roast soyabeans and black gram dal separately and powder.

(2) Grind the above powder with coconut, heeng, chillies, tamarind and salt into a coarse pasts.

(3) Season with mustard seeds and curry leaves.

9. Soya - Suji Uppuma :

Ingrediants :

Soya flour	-	25 g
Medium Suji	-	100 g
Medium sized Onion	-	1 (chopped)
Green chillies	-	5 (chopped)
Mustard seeds	-	1 tsp
Chopped coridander leaves	-	1 tsp
fat	-	2 Tbsp
Scraped coconut	-	1 tsp
Water	-	1½ C
Salt	-	according to taste

Method :

(1) Roast soya flour in hot Karahi till it turns light brown, add 1 tsp of fat and soya until golden brown.

(2) Brown suji with ½ tsp fat.

(3) Mix both together

(4) In the remaining fat, fry mustard seeds, chopped onion, chillies and gram.

(5) Add browned mixture and mix along with salt.

(6) Sprinkle water little by little with constant stirring.

(7) In the end, add scraped coconut and chopped coriander leaves.

(8) Clos with a lid and leave on slow fire for 10 minutes.

10. Soya Vadi :

Ingredients :

Soya dal	-	30 g
Black gram dhal	-	25 g (washed)
Salt	-	5 g
Turmeric powder	-	2 g
Red chilli powder	-	5 g
Fat	-	30 g
Water	-	50 ml

Method :

(1) Soak black gram dhal and soya dhal separately overnight.

(2) Grind black gram dhal and soyabean with water to a thick paste.

(3) Add turmeric, chilli powder and salt

(4) Shape into small balls and deep fry till golden brown.

11. Soya Flour Milk :

Ingredients :

Soya flour	-	100 g
Boiling water	-	3 C
Soda	-	¼ tsp
Sugar	-	3 Tbsp
Essence	-	¼ tsp (Vanilla or almond)

Method :

(1) Mix soyaflour with ½ C water to a thick paste.

(2) Add the rest of 2½ C of boiling water to the paste.

(3) Stir well, strain with a muslim cloth.

(4) To the filtrate add ¼ tsp of soda.

(5) Boil for 15 minutes.

(6) Add sugar and essence and serve hot.

APPENDIX - I

NUTRITION EDUCATION - LECTURE

புற்றுநோய் மற்றும் சுகாதார முறைகள் பற்றிய பேச்சு

உங்கள் அனைவருக்கும் என் காலை வணக்கம்.

இன்று காலை இங்கு அனைவரும் கூடி வந்திருப்பதற்கு என் நன்றியை தெரிவித்துக் கொள்கிறேன்.

'நீ எதை சாப்பிடுகிறாயோ அது தான் நீ' என்ற பழைய வாக்கு அர்த்த புஷ்டியும் அறிவு நிறைந்ததுமாயிருக்கிறது. உடல் நலம் நன்றாக உள்ளவர்களுக்கும், உடல் நலம் பாதிக்கப்பட்டவர்களுக்கும் சத்துணவு இப்போது ஒரு முக்கிய தேவையாக இருக்கிறது. உங்களில் அநேகர் புற்று நோயால் பாதிக்கப்பட்டவர்களும் அவர்களின் சொந்தக்காரர் மற்றும் நண்பர்களாக கூடியிருக்கிறீர்கள்.

சத்துணவு சம்பந்தப்பட்ட விஷயங்களை உங்கள் அனைவருக்கும் பயன்படும் விதத்தில் சுருக்கமாக எடுத்துக் கூற விரும்புகிறேன்.

இந்தியாவில் இறக்கும் 10 முக்கிய வியாதிகளில் புற்றுநோயும் ஒன்றாகும். புற்று நோய் என்ற வார்த்தை கர்க்கடம் என்கிற வார்த்தையிலிருந்து வந்தது ஆகும். அதன் அர்த்தம் நண்டு. ஏனென்றால் புற்றுநோய் ஒழுங்காக அல்லது உருண்டை மற்றும் முக்கோண வடிவில் வளர்வதில்லை. ஆனால் நீட்டிக் கொண்டு நண்டின் காலைப் போல் நீண்டுவளர்கிறது. இந்த நோயின் காரணங்கள் அநேகம். பொதுவாக சத்துணவின்மை, பொதுவான பலவீனம், சோகை, எடை குறைவு, மயக்கம், பசியின்மை, சரீரத்தில் குறிப்பிட்ட இடத்தில் வீக்கம், குணமடையாத புண், இருமல், பெண்களிடம் ரத்தக் கரை வெளியாகுதல் முதலியன.

ஆண்களிடம் பொதுவாக காணப்படுவது நுரை ஈரல் புற்று நோயும் பெண்களிடம் மார்பு புற்றுநோயுமாகும். புற்றுநோய் உண்டாக காரணம் பலவாகும். சில காரணங்கள் புற்றுநோய் உண்டாக உதவுகிறது. சில புற்றுநோய் அதிகம் வளர உதவுகிறது. தப்பான ஆகாரம் மற்றும் தவறுன வகையில் உடல் செயல்படுதலும் வேறு காரணங்களாகும். வெளியில் சுற்றுப்புற சூழ்நிலையாலும் நாம் சாப்பிடும் ஆகாரம் மூலமும் உடம்பில் மாறுதல் ஏற்படுகிறது. புற்றுநோய் வர முக்கிய காரணங்களாவன புகையிலை, மது வகைகள் அதிகம் காப்பி சாப்பிடுவது, போதை மருந்துகள், சுற்றுப்புற சூழ்நிலை, அசுத்த ஜீவியம், தொழிலில் உள்ள கோளாறுகள், அதிக அளவு வெற்றிலை புகையிலையுடன் போடுதல் மற்றும் குடும்ப பரம்பரை வாயிலாக வரும் புற்று நோய் ஆகும்.

நாம் சாப்பிடும் தரமுள்ள, அளவான சாப்பாடு, சமையல் செய்யும் வகைகள் சாப்பிடும் பழக்கம் முதலியன ஒரு மனிதனின் நல்ல தேக ஆரோக்கியத்திற்கு பெரிதும் உதவுகின்றன. சத்துணவும் தேக ஆரோக்கியத்திற்கான சில முக்கிய குறிப்புகளும் புற்றுநோய் உள்ளவர்களுக்கு உதவியாகவும், புற்றுநோய் இல்லாத-வர்களுக்கு நோய் வியாதி வராமலிருக்கவும் உதவுகிறது.

<u>பாதுகாக்க உதவும் முக்கிய விஷயங்கள் எவை</u>

1. அதிக முட்டைகோஸ் (Cabbage) சாப்பிடுதல். குடும்ப காய்கறிகள் அதாவது காளிபிளவர், முட்டைகோஸ் (Cabbage), காலாகோஸ், முதலியன வயிற்று புற்றுநோய் மற்றும் சுவாச புற்றுநோயிலிருந்து காக்க உதவுகிறது.

2. ஏ, பி வைட்டமின் சத்துள்ள உணவு சாப்பிடுவதன் மூலம் நுரை ஈரல் புற்று வராமல் பாதுகாக்கப்படுகிறது. புதிய பச்சையாக உள்ள பழங்கள், பச்சை காய்கறிகள் அதாவது பச்சை, மஞ்சள் நிறமுள்ள காரட், கீரை முட்டைகோஸ், தக்காளி, ஆரஞ்சு, எலுமிச்சைப் பழம், சாத்துக்குடி முதலியவற்றை அதிக அளவில் சாப்பிட வேண்டும்.

3. எடை அதிகரிப்பதைத் தவிர்ப்பதனால் நீரிழிவு, இருதய நோய் மற்றும் மார்பு புற்று நோய் வராமலிருக்க உதவும். சரியான உடல் பயிற்சியும், நார் உள்ள உணவும் சாப்பிடுவதன் மூலம் எடை அதிகரிப்பதைத் தவிர்க்கலாம். சாதாரணமாக நடப்பது உடல் நலத்திற்கு மிகவும் நல்லது.

<u>ஆபத்தை விளைவிக்கும் முக்கிய காரணங்கள் யாவை</u>

1. அதிக அளவில் வேக வைத்த உணவுப் பண்டங்கள் சாப்பிடுவதைக் குறைக்கவும். அதாவது சர்க்கரை, பிஸ்கெட்டுகள், சாக்லெட்கள், இனிப்புகள் முதலியன.

2. கொழுப்பு சத்துள்ள வெண்ணை, நெய், தேங்காய் எண்ணை முதலியவற்றை குறைக்கவும். ஆடு, மாடு மற்றும் பன்றி இறைச்சிகளில் உள்ள கொழுப்பு சத்துக்களை நீக்கி உண்பதுடன் அதற்கு பதில் கோழி இறைச்சியை அதிகம் சேர்ப்பது நல்லது.

3. ஊறுகாய், அப்பளம், வத்தல், வடகம் மற்றும் அதிகம் எண்ணையும், உப்பும் சேர்த்து செய்த பதார்த்தங்கள் சாப்பிடுவதைக் குறைத்தல் வேண்டும்.

4. சிகரெட், பீடி பிடிப்பதை உடனே நிறுத்த வேண்டும். ஏனென்றால் 100க்கு 30 பேருக்கு நுரை ஈரல் புற்று- வர இது காரணமாக இருக்கிறது. புகையிலை மெல்வது வாய் & தொண்டை புற்றுநோய் வர காரணமாக இருக்கிறது.

5. குடிக்கும் பழக்கம் இருந்தால் அதை உடனே நிறுத்த வேண்டும். முடியவில்லை என்றால் அளவாக அருந்தவும். குடிப்பதனால் ஈரல் புற்று வர வாய்ப்பு அதிகரிக்கிறது.

6. வெளியே ஓட்டல்கள், கான்டீன்கள் மற்றும் பொது இடங்களில் சாப்பிடுவதை தவிர்க்கவும். ரோடுகளில் விற்பனை செய்யும் சுகாதார முறைப்படி தயார் செய்யாத உணவுப் பொருட்களை சாப்பிடக்கூடாது.

7. கருகலாக வருத்த அல்லது எண்ணெயில் அதிகம் வேக வைத்த பண்டங்களை சாப்பிடுவதைத் தவிர்க்கவும். பதிலாக ஆவியில் வேக வைத்த பொருட்களை சாப்பிடவும்.

மேற்கண்ட விதிமுறைகளை கடைபிடிக்க ஒரு தீர்மானம் செய்து அதன்படி நடந்தால் அது உங்களுக்கு உடல் நலத்திற்கு மிகவும் பிரயோஜனமாக இருக்கும்.

நன்றி !