

## Diet, body fat & plasma lipids in breast cancer

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Revised article received December 13, 1984

Sixty-eight women with histologically proven breast cancer and 33 normal healthy women matched for social class were studied with regard to their dietary intake, body fat, total plasma cholesterol, triglycerides, and lipoprotein fractions, *viz.*, very low density lipoprotein (VLDL), low density lipoprotein (LDL) and high density lipoprotein (HDL). No significant differences were found in the total body mass, plasma cholesterol and its fractions as also in total plasma triglycerides in the two groups. Significant differences were, however, observed between the two groups in the total intake of calories and fat and also in plasma HDL-triglyceride values. Breast cancer patients showed a higher intake of total calories and fats which is perhaps reflected in the triglyceride fraction of the HDL only.

Breast cancer is a multifactorial disease. Data from various studies suggest that high fat diet, obesity and large body mass increase the risk for developing breast cancer<sup>1</sup>. Wynder *et al*<sup>2</sup> have shown that a high calorie intake is associated with an increased incidence of breast cancer in the US. A case-control study in Canada<sup>3</sup> has shown a significant difference in the total calorie and fat intake between normal persons and patients with breast cancer. Prospective studies among the Seventh Day Adventists living in the US<sup>4</sup> and among the Japanese living in Hawaii showed that patients with breast cancer consumed large amounts of foodstuffs rich in fat<sup>5</sup>.

Experimental studies<sup>6,7</sup> have shown that dietary calorie restrictions decrease the

incidence of mammary tumours in rodents and feeding of polyunsaturated fats leads to an increased incidence of mammary tumours in these animals<sup>8,9-11</sup>. This has led to the impression that polyunsaturated fats may enhance tumour formation more than the saturated fats<sup>12,13</sup>.

Studies have suggested that breast cancer patients with high serum cholesterol levels have a poor prognosis<sup>14</sup> and women with increased serum cholesterol levels run a higher than normal risk for breast cancer<sup>15</sup>.

It is not known, however, whether the total dietary fat intake and the levels of plasma cholesterol and other lipids are different in patients with breast cancer from those in normal persons of the same

community. We therefore, undertook a study on the dietary intake and nutritional status as also the total plasma cholesterol, triglycerides and plasma lipoprotein percentages in breast cancer patients, as compared to normal subjects.

### Material & Methods

Sixty eight patients with breast cancer diagnosed in the surgical clinics of the All India Institute of Medical Sciences, New Delhi, during the period 1982-83 were included in the study prior to institution of chemotherapy. Thirty three women matched for social class were derived from the hospital out-patients' department. There were patients with ailments other than cancer, diabetes mellitus, coronary artery disease and gallstone disease. The menopausal status of each control as well as the test subject was recorded. A detailed dietary history was obtained by one of the authors (SP who is a dietician) for each subject on the basis of recall of the typical dietary intake of the subject in 24 h. Care was taken to also record the diet taken prior to the onset of symptoms of the present ailment. The daily intake of total calories, carbohydrates, proteins, fats and refined carbohydrates (such as sugar and jaggery) was then calculated for each subject from these estimates.

The height and weight measurements of each subject were recorded individually and compared with the standard height and weight charts of the Life Insurance Corporation of India (LIC). The nutritional status was evaluated<sup>16,17</sup> by the Quetelet index (*i.e.*, weight/height<sup>2</sup>).

Venous blood samples were collected from the subjects after fasting for 14 h. The blood samples were collected in vials

containing disodium EDTA. Plasma was separated from the samples by centrifugation at 2500 g for 20 min and stored at 4°C. All the samples were analysed within 48 h. Quantification of lipoprotein fractions was carried out using the dual precipitation technique of Wilson and Spiger<sup>18</sup>. Cholesterol and triglycerides were determined in the plasma HDL and LDL+VLDL fractions by the methods of Chiamori and Henry<sup>19</sup> and Van Handel and Zilversmit<sup>20</sup>, respectively. Specific values in VLDL were obtained by subtraction. Statistical analysis was done using the Student's 't' test and Wilcoxon's method.

### Results

The mean age of breast cancer patients was 45.9 yr and that of controls 37.2 yr. The mean height and weight of breast cancer patients were 153.6 cm and 58.5 kg and of controls 154.4 cm and 55.8 kg, respectively. The Quetelet index was 24.7 in breast cancer patients and 23.8 in controls. The heights and weights of both the groups of subjects were also not different from the standards shown in the LIC tables. Of the 68 breast cancer patients, 43 had attained menopause, while in the control group, 15 were postmenopausal, which was not widely different from the case among the breast cancer patients. The controls were thus comparable with the cancer patients except for the slight difference in their mean ages (Table I).

Dietary study however, revealed that the breast cancer patients had a significantly higher intake of total calories as well as fat as compared to the controls ( $P < 0.05$ ). Fats contributed 33.1 per cent to the total calorie intake in controls and 37.5 per cent in case of breast cancer patients (Table II).

Table I. Age and body mass index (mean  $\pm$  SD)

Group	Age (yr)	Height (cm)	Weight (kg)	Quetelet index*
Breast cancer patients	45.94 $\pm$ 9.52** (68)	153.62 $\pm$ 5.42 (66)	58.49 $\pm$ 11.60 (66)	24.7 $\pm$ 5.8 (66)
Controls	37.97 $\pm$ 9.15 (33)	154.40 $\pm$ 5.58 (25)	55.84 $\pm$ 14.10 (25)	23.80 $\pm$ 5.6 (25)

\*Weight in kg divided by height in square metres; \*\* $P < 0.001$ . Figures in parentheses indicate the number of subjects studied

Table II. Daily intake (mean  $\pm$  SD) of calories (kcal) and other dietary components (g)

Group	Calories	Carbohy- drates	Proteins	Fat	Refined carbohy- drates
Breast cancer patients	1810.92* $\pm$ 475.30 (64)	224.83 $\pm$ 59.38 (64)	51.62 $\pm$ 15.16 (64)	75.46* $\pm$ 31.20 (64)	30.62 $\pm$ 34.18 (61)
Controls	1646.41 $\pm$ 337.63 (32)	221.38 $\pm$ 48.63 (32)	51.19 $\pm$ 13.18 (32)	60.47 $\pm$ 24.19 (32)	25.03 $\pm$ 14.05 (30)

Figures in parentheses indicate the number of subjects studied. \* $P < 0.05$

$p = 0.02$

Table III shows the mean serum lipoprotein values obtained in the two groups of subjects. Of all the lipoprotein fractions, only the HDL-tryglyceride was found to be significantly higher in breast cancer patients as compared with controls.

### Discussion

The association between high calorie and total fat intake in breast cancer patients has been brought out quite clearly by the results of the present study. Although there could be some reservation

regarding the validity of data obtained by the recall method in dietary studies, it is noteworthy that our findings are in conformity with those of the earlier studies<sup>2-6</sup>.

The control women were somewhat younger than those with breast cancer; however this difference in the ages cannot be considered to affect the comparability of the two groups, because their Quetelet indices were comparable. Carroll<sup>21</sup> reported a positive correlation between breast cancer incidence and the dietary intake of fat and total calories in epidemiological

**Table III.** Plasma lipoproteins (mg/dl) in breast cancer patients and controls(Data are mean  $\pm$  SD)

Plasma lipoprotein	Breast cancer patients	Controls (n=33)
<i>Cholesterol:</i>		
Total	194.11 $\pm$ 47.63 (47)	169.27 $\pm$ 42.12
VLDL	62.17 $\pm$ 28.83 (47)	51.42 $\pm$ 25.99
LDL	79.48 $\pm$ 41.32 (46)	82.12 $\pm$ 33.45
HDL	45.94 $\pm$ 21.18 (46)	36.26 $\pm$ 26.62
<i>Triglycerides:</i>		
Total	172.93 $\pm$ 64.25 (44)	163.91 $\pm$ 71.58
VLDL	49.05 $\pm$ 42.16 (40)	53.30 $\pm$ 58.26
LDL	27.42 $\pm$ 26.80 (41)	43.61 $\pm$ 43.37
HDL	95.45 $\pm$ 26.92* (42)	71.09 $\pm$ 35.53

Figures in parentheses indicate the number of subjects. \* $P < 0.001$

studies. Animal experiments showed further that dietary fat alone had an effect which was independent of total calorie intake. De Waard *et al*<sup>22</sup> found in their case control studies, conducted in the cities of Rotterdam and Hague and in Japan, that breast cancer patients with metastases in axillary nodes were significantly heavier but not taller than those without nodal involvement. These authors postulated that a hormonal factor related to body weight or height could be responsible for the increased incidence of breast cancer in women with a large body mass. Increased body weight and height of

Japanese migrating to Hawaii and California reflect changes in nutritional status which makes them more prone to develop breast cancer<sup>23</sup>. It was, however, surprising that no difference was observed in weight and Quetelet index between the patients with breast cancer and controls in the present study. It is possible that the wasting and debility associated with cancer could have caused a reduction in the body weight. Unfortunately, the body weights of patients prior to developing cancer could not be ascertained. In contrast, the dietary intakes related to periods prior to the appearance of the cancer symptoms, which may be the reason for the discrepancy between the increased calorie and fat intake and the lack of obesity in our patients.

A significant difference was found in HDL-triglyceride while there was no difference in the total cholesterol content and lipoprotein fractions. Other workers<sup>24,25</sup> have also not found any difference in the serum cholesterol values of breast cancer patients and controls. On the other hand, low cholesterol concentrations have been found in several prospective studies of colonic cancer patients and are alleged to be due to the cancer<sup>6-27</sup>. Barclay *et al*<sup>28</sup> reported that patients with advanced breast cancer had high values of HDL-cholesterol, whereas in our study no difference was found in this parameter between the two groups. The discrepancy in the findings of different investigators perhaps reflects the differences in the dietary and environmental factors in the various series of patients.

No attempt has been made in earlier studies to determine the relative distribution of triglycerides in VLDL, LDL and

HDL which was done in the present study. The significance of the finding of higher than normal HDL-triglyceride in breast cancer patients in our study is not clear but may be related to the high caloric and refined carbohydrate intake.

It has been suggested that the increased risk for breast cancer on high fat intake is acquired either through changes in serum lipids or its fractions or through body weight or through changes in oestrone<sup>29,30</sup>. According to Correa<sup>31</sup> dietary items are perhaps not direct carcinogens but they act as promoting carcinogens.

One could expect that factors operating in the causation of breast cancer also influence the prognosis of the condition. Initial trials in the United States however, did not furnish adequate scientific evidence to suggest that lowering of the intake of dietary fat could result in reduction of death rate due to cancer<sup>32</sup>. A follow-up of patients in our series may provide an answer to the question of whether the prognosis is influenced by the high caloric and fat intake. Further, the estimation of cholesterol and triglyceride fractions may also prove to be a prognostic marker.

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