The Epidemiology of Breast Cancer in Singapore

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Breast cancer is the most frequent cancer in Singapore, which showed rapid increase in incidence in the last two decades. A case-control study consisted of 200 histologically confirmed cases and 420 controls was carried out between 1986 and 1988. The results were as follows; in premenopausal women, the increased risk was associated with high red meat intake and high animal protein intake and the decreased risk was associated with high polyunsaturated fatty acid (PUFA) intake, high soya protein and total soya intake, high PUFA: SFA (saturated fatty acids) ratio, and high soya/total protein. The significant factors after multiple regression analyses of dietary effects were predisposing effect of red meat and protective effect of high intake of PUFA, b-carotene and soya/total protein. In postmenopausal women no significant factors were found for any of dietary effects. The findings were mainly confined to younger premenopausal women who have exhibited major changes in their diet.

Breast cancer, Case-control study, Polyunsaturated fatty acids, b-carotene, Soya/total protein, Red meat

INTRODUCTION

Although breast cancer is the most frequent cancer in Singapore, the incidence rates are about half those of the Western Caucasian populations. Within Asia, the rates in Singapore and Hong Kong are very similar to those of US Chinese, the these are about twice those in China (Shanghai) and Japan(1) Indian populations have rates in between, and Malays the lowest rates known. Thus, it can be seen that breast cancer remains very much a problem of the developed Western world.

Descriptive Studies

The most striking epidemiological feature of this cancer in Singapore is the rapid increase in incidence in the last two decades. It has been increasing at about 3% annually since population-based cancer registration started in 1968(2). The bulk of the increases are occurring in women below 50 years of age, those born after 1930.
The latest age-standardized incidence rates ASIR, (1983–1987) for the main ethnic group in Singapore are as follows:

<table>
<thead>
<tr>
<th>Ethnic Group</th>
<th>% in Population</th>
<th>SIR per 10^5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese</td>
<td>76</td>
<td>32.3</td>
</tr>
<tr>
<td>Malays</td>
<td>15</td>
<td>22.4</td>
</tr>
<tr>
<td>Indians</td>
<td>6</td>
<td>34.6</td>
</tr>
</tbody>
</table>

It would be useful and interesting to try and determine the possible reasons for the increase in the younger women, most of whom are premenopausal. Because of our highly successful population control programme, fertility in Singapore women has declined markedly since 1965 with the implementation of the First National Family Planning Programme. Looking at age-specific fertility rates, the decline is very strong in the age-groups 20 to 34 years(3).

At the same time, Singapore has undergone dramatic changes on the socio-economic scene. With rising affluence in an open economy, lifestyles have become more Westernized and this includes dietary patterns as well. In the 20-year period (1961–1983), food availability has increased dramatically. Increases were seen for meat (135%), fat, especially from animals (73%), eggs (79%) and fruits (61%). In terms of nutrient availability, per capita calorie supply has increased 25%, protein 34% and fat 67%(4).

An Analytical Study

Between 1986 and 1988, we conducted a case-control study among Singapore Chinese women(5). The numbers in the other two major ethnic groups are too small for meaningful study. After eliminating some refusals and unsatisfactory cases (including diabetics), we managed to accrue 200 histologically confirmed incident cases. Controls were selected from general surgery, eye and orthopaedic wards of the same hospitals and group-matched within 5-year age groups. In all, we had 420 controls.

All subjects were interviewed by trained investigators, using a quantitative food frequency questionnaire to determine usual dietary intake one year before interview. Based on past literature, information on sources of the following nutrients were obtained:

- animal and non-animal protein
- fat
- saturated fatty acids (SFA)
- monounsaturated fatty acids (MUFA)
- polyunsaturated fatty acids (PUFA)
- cholesterol
- β-carotene
- vitamin E
- theobromine, caffeine and methylxanthines

In terms of food groups, the following were of particular interest:

- total red meats
- coffee
- total fish
- total soya products
Alcohol intake was not assessed as Chinese women were thought to take little of the drink. For the analysis, intakes of nutrients and foods were categorized into tertiles of the control range and fitted into the multiple logistic regression model. Data for the premenopausal and postmenopausal (at least 1 year after cessation of menses) were considered separately, and adjustments for relevant non-dietary variables were made in each group. The results point to important differences in the epidemiology of premenopausal breast cancer and the postmenopausal group. Premenopausal women comprised 54% of cases and 49% of controls. While one cannot rule out endocrinal explanations, the more likely reason is because of the many dietary and other changes occurring in the younger group. Heterogeneity in dietary intakes in the postmenopausal group was insufficient to show differences and comparisons generally lacked statistical power.

Premenopausal Group

The main findings in premenopausal women were as follows:

1) *Increased risk was associated with:*
   - high red meat intake
   - high animal protein intake

2) *Decreased risk was associated with:*
   - high PUFA intake
   - high β-carotene intake
   - high soya protein and total soya intake
   - high PUFA: SFA ratio
   - high soya/total protein

3) *After multiple regression analyses of dietary effects, the only significant factors left were (Table 1):*
   - predisposing effect of red meat
   - protective effect of high intake of PUFA, β-carotene and soya/total protein

<table>
<thead>
<tr>
<th>Nutrient/food</th>
<th>Control third</th>
<th>OR²</th>
<th>(95% CI³)</th>
<th>Significance⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUFA</td>
<td>1</td>
<td>1.00</td>
<td>-</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.39</td>
<td>(0.19, 0.79)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.40</td>
<td>(0.19, 0.85)</td>
<td></td>
</tr>
<tr>
<td>Beta-carotene</td>
<td>2</td>
<td>0.74</td>
<td>(0.40, 1.40)</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.33</td>
<td>(0.16, 0.69)</td>
<td></td>
</tr>
<tr>
<td>Soya/total protein</td>
<td>2</td>
<td>0.82</td>
<td>(0.46, 1.48)</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.39</td>
<td>(0.19, 0.80)</td>
<td></td>
</tr>
<tr>
<td>Red meat</td>
<td>2</td>
<td>2.39</td>
<td>(1.15, 4.95)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3.99</td>
<td>(1.87, 8.51)</td>
<td></td>
</tr>
</tbody>
</table>

1. Variables adjusted for each other, age, and age at birth of first child
2. OR – Odds ratio
3. CI – Confidence interval
4. P-value for test for trend on 1 degree of freedom; NS indicates p > 0.1
Postmenopausal Group

The findings in postmenopausal women as follows:

1) No significant factors were found for any of the dietary effects, after studying the data from various approaches

Thus, our dietary findings were mainly confined to younger premenopausal women who have exhibited major changes in their diet. The predisposing effect of high red meat intake is consistent with some recent results reported by La Vecchia et al.\(^6\) and Toniolo et al.\(^7\) The situation regarding fats, especially animal (or saturated) fats, is unsettled, with many prominent researchers tending to ignore their effects.

The protective effect of beta-carotene is again corroborated by other studies\(^6,8-10\). High PUFA intake was also found to be protective even after multiple analyses to rule out indirect links to other nutrients.

The most interesting finding is the likely protective effect of soyabean products. So far the only important reports have been based on animal studies, where soya diets have been shown to be effective in suppressing breast tumour incidence in rats. At one time, it was thought to be due to the presence of protease inhibitors\(^11\), but of late the more likely mechanism is due to the effect of phyto-oestrogens which are readily available in soyabean\(^12\). These phyto-oestrogens (e.g. isoflavones such as daidzein and genistein) are bacterially converted in vivo into equol, which is antagonistic to oestradiol-17\(\beta\) in binding to the oestrogen-receptor in the nucleus but failing to initiate replenishment of the receptors in the cytoplasm. Such anti-oestrogenic activity may well counteract the predisposing effect of oestrogens in this hormone-dependent cancer.

The 2- or 3-fold difference in breast cancer incidence between women in the West and those in China and Japan has been the subject of much speculation and research interest. Bernstein et al.\(^13\) reported significantly lower luteal-phase oestradiol concentration of premenopausal Chinese women in Shanghai compared to white women in Los Angeles. The other partial explanation may well be the difference in intake of soya products – about 13% of daily protein intake in Japan compared to 2% in Americans\(^14\). In Singapore, soya protein accounts for 6-7% of total intake.

The potential of soyabean as a protective food against hormone-dependent cancers and even circulatory diseases is tremendous, seeing that it is an important source of cheap protein. Further work on this food item is indicated.

REFERENCES


