Salmon intake and cancer risk –
"A bit of epidemiological data"

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The widespread interest in mass media after the release of the article by Hites et al in Science (1) prompted us to look after the postulated association between increased intake of farmed salmon and cancer. The estimates given by Hites et al were based on measurements in fish filets and the use of EPA derived guidelines of maximum amount of farmed salmon to be eaten before boosting cancer risk by 1 case in 100,000. Their recommendations were not to eat more than half a dinner serving or 110 g per month of farmed salmon of North Atlantic origin. This upper limit of intake was strongly incompatible by the recommendations of the American Heart Association of 168-336 g per week, or the FDA recommendations.

The site of cancer was not specified, but dioxins are considered as potential hormonal disrupters. The level of dioxin in the samples was 2.5 pg TEQ/g compared to 35 microgram of oestradiol in the most commonly used oral contraceptive brands. Oral contraceptives are known to give an increased risk during current use of 35-40% for breast cancer, and protect against ovarian and endometrial cancer.

The Norwegian per capita consumption of farmed salmon and trout is estimated to be 9 g per person per day or about 300 g per month, three times the limit given by Hites et al.

In order to study the relationship between intake of farmed salmon and trout, we used the Norwegian Women and Cancer study – NOWAC (2). Part of this study is primarily constructed for the studies of associations between seafood consumption in Norway and cancer incidence. We used information from two subcohorts; one with the first questionnaire in 1996/97 and the other with a second questionnaire in 1998, altogether 65618 women with follow-up through 2003 based on linkage to the Cancer Registry of Norway. The women comprise a representative random sample of women in Norway.

Exposure information was detailed with information on type of fish, seasonal intake, frequency and amount for dinner as for spread on bread. We have performed validation studies comparing questionnaire intake with measured fatty
acids, repeated 24-hours recall and telephone interviews for estimating the proportion of wild red fish intake. The results are given in Table 1.

This is the only epidemiological evidence so far of the relationship between salmon and trout intake and cancer incidence. Our conclusion is that consumption of farmed salmon or trout from the North Atlantic region did not increase the risk of cancer.

References


Table 1. Relative risk (RR) with 95% confidence interval (95% CI) for incidence of total cancer, breast cancer, and liver cancer according to consumption of farmed salmon; 64658 women aged 41 to 70 years at date of enrolment 1996-1998, with follow-up through 2003. Cox proportional hazard model was employed. N = total number of respondents.

<table>
<thead>
<tr>
<th>Consumption</th>
<th>Total cancer&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Breast cancer&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Liver cancer&lt;sup&gt;3&lt;/sup&gt;</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>N (N cases) RR (95% CI)</td>
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<td>N (N cases) RR (95% CI)</td>
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<tr>
<td>≤ 110 g/month</td>
<td>17710 (765) 1.00</td>
<td>18969 (251) 1.00</td>
<td>22094 (3) 1.00</td>
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<tr>
<td>&gt; 110 g/month</td>
<td>37439 (1447) 0.95 (0.87-1.04)</td>
<td>38809 (539) 1.00 (0.86-1.17)</td>
<td>42564 (2) 0.34 (0.055-2.04)</td>
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</table>

1) Adjusted for age, energy intake (continuous), consumption of herring and mackerel (≤87g/month, 88 to 350 g/month, >350 g/month), consumption of fish liver (yes/no), body mass index (≤18.5, 18.6 to 25.0, 25.1 to 30, >30), current smoker (yes/no), alcohol consumption (no consumption, 1 to 60 g/month, >60 g/month), level of activity.

2) Adjusted for age, energy intake (continuous), consumption of mackerel and herring (≤87g/month, 88 to 350 g/month, >350 g/month), consumption of fish liver (yes/no), body mass index (≤18.5, 18.6 to 25.0, 25.1 to 30, >30), menopausal status (post/pre menopausal), living in regions with a breast screening programme, breast cancer in mother, alcohol consumption (no consumption, 1 to 60 g/month, >60 g/month), number of births (0, 1, 2, >3), age at first birth (≤20, 21 to 24, ≥25), use of oral contraceptives (yes/no), and use of hormone replacement therapy (yes/no).

3) Adjusted for age.