Associations of Individuals' Health-related Behavior with Their Own or Their Spouses' Smoking Status

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Background: Many studies indicated that smokers have poor health habits such as high alcohol consumption and imbalanced nutrient intakes. These habits could affect the health-related behavior of smokers’ families.

Methods: To investigate the relationship between an individual’s health-related behavior (nutrient intakes and participation in cancer screening) and their spouses’ smoking status, we analyzed data collected using a self-administered questionnaire during a cohort study. We compared nutrient intakes and cancer screening participation rates between subjects grouped according to their spouses’ smoking status, using a multivariate linear regression model to adjust for each subject’s age and alcohol consumption.

Results: There was an association between husbands’ and wives’ smoking status (never and current only). Poor micronutrient intakes and cancer screening participation rates were associated with both the subjects’ and their spouses’ smoking habits. This tendency was most apparent among male smokers and nonsmoking women. However, among nonsmoking men and female smokers, there were no statistically significant differences between groups classified according to their spouses’ smoking status.

Conclusion: Spouses’ smoking habits were associated with poor health-related behavior in their partners. J Epidemiol, 1998; 8 : 42-46.

smoking, spouse, lifestyle, diet, cancer screening

There are many studies of the characteristics of smokers 1-8). These have shown that smokers drink more alcohol 2,5,6), take less exercise 3,6), eat fewer vegetables (particularly green vegetables) and have lower micronutrient intakes 1,3,7,8). These imbalanced nutrient intakes observed among most smokers may trigger many chronic diseases and cancer, because appropriate nutrient intake is one of the most important preventative or counteractive factors against these diseases 9,10,11). Moreover, patients who smoke and develop cancer may be diagnosed at a more progressive stage than those who do not smoke because the former do not willingly participate in medical check-ups 12,13).

The problems caused by tobacco may not be restricted to smokers themselves. It is reported that the behavior of smokers have a ripple effect on the lifestyle of other family members and work colleagues who were nonsmokers 8,14,15). However, there are no studies comparing lifestyle with smoking status (never and current only) in both subjects and their spouses.

We hypothesized that there would be a relationship between an individual’s poor health-related behavior and his/her spouse’s smoking habit. To investigate this relationship, we focused on individuals’ nutrient intake and participation in screening programs for both stomach and lung cancer.

SUBJECTS AND METHODS

In September 1992, we started a cohort study to investigate associations between lifestyle, cancer and chronic diseases 16). We distributed self-administered questionnaires inquiring about lifestyle (including dietary habits) to 36,990 residents aged 35 years or over of a city in a rural area of Japan (total...
population = 37,322 as of July 1, 1992) and received 34,018 responses (response rate = 92.0%). After excluding ineligible respondents, 31,552 (85.3%) of these subjects were included in our study.

The questionnaire included questions on food consumption, smoking and drinking habits, medical histories for 23 diseases (cancer and chronic diseases), frequency of participation in screening programs for stomach cancer and lung disease (lung cancer and tuberculosis), and other information, such as birth date, sex, height and weight. We labeled every questionnaire from the same household with the same number to enable us to identify members of the same family.

Food consumption responses (including alcohol) were based on subjects’ recall over the previous year, and were classified by frequency and portion size for each of 169 food items. These included foodstuffs, processed foods and dishes. We adopted eight categories (never, once a month, 2 to 3 times a month, once a week, 2 to 3 times a week, 4 to 6 times a week, once a day and 2 or more times a day) for the food frequency assessment and nine categories (never, once a month, 2 to 3 times a month, once a week, 2 to 3 times a week, 4 to 6 times a week, once a day, 2 to 3 times a day and 4 or more times a day) for the alcohol and other drink frequency assessment. For portion size assessment, we used two to four response categories, depending on the kind of food; e.g. for milk, the response had three categories (1/2 glass, 1 glass and 2 glasses or more). Individual nutrient intake was established from the food frequency and portion size data using “Japan Food Composition Tables, 4th edition”17.

We assessed the validity of the food consumption data in our questionnaire using three surveys: one 3-day record, four telephone interview to assess 24-hour recall and twelve 1-day records made over a 1-year period at intervals of approximate-ly one month. Rank correlation coefficients for nutrients (calories, proteins, lipids, saturated fatty acids, polyunsaturated fatty acids, monounsaturated fatty acids, nonfibrous carbohydrates, fiber, salt, cholesterol, calcium, phosphorus, iron, sodium, potassium, retinol, carotene, vitamin A, vitamin B1, vitamin B2, niacin, vitamin C, vitamin D and vitamin E) between each survey and the questionnaire used in this study were 0.18-0.54 for the 3-day record, 0.11-0.40 for the 24-hour recalls and 0.27-0.72 for the 1-day records, respectively.

We classified smoking status responses as never, past and current. We used two categories (never and more than once) to describe participation in cancer screening programs over the past three years to avoid confusion of cancer screening with any work-up undergone after the screening. As the question-naire did not specifically identify each subject’s spouse, the following 4 conditions were used to identify married couples.

1. The pair consisted of a man and a woman with the same household number; (2) The difference between their ages was less than 15 years; (3) Both the man and the woman marked their marital status as “married”; (4) He or she belonged to only one pair. We identified 11,040 pairs and included pairs in which both the husband and wife had no positive medical history for the 23 chronic diseases and cancers listed in the ques-tionnaire (high blood pressure, heart attack/angina, stroke, diabetes, tuberculosis, gout, intestinal polyps, gastrointestinal ulcers, partial removal of the stomach, kidney stones, gallstones, gallbladder removal, blood transfusions, allergy, colon or rectal cancer, stomach cancer, melanoma, other skin cancer, breast cancer, prostate cancer, cancer of the cervix, other uter-ine cancer and other cancers) in order to avoid the effects of any treatment on their current diet and participation in cancer screening. The number of pairs in which either the husband or wife had a positive medical history was 8,001. We deleted 766 pairs in which either the husbands or wives were past smokers to clarify the influence of smoking habits on their lifestyle. Unaffected men and women from 2,273 of these pairs acted as individual control subjects. Analysis of participation rates was limited to subjects aged 43 years and over because, according to the Health and Medical Services for the Aged Act, screening for stomach and lung cancer are provided only for the people older than 40 years.

Nutrient intakes (divided by individual calorie intake) and cancer screening participation rates over the past three years were compared between two groups classified by their spouses’ smoking status after controlling for subjects’ age (years) and alcohol consumption (grams of ethanol). The analysis of energy was adjusted for each subjects’ body mass index (BMI) in addition to their age and alcohol consumption. Analyses were performed using a multivariate linear regression model with the computer program PC-SAS, version-6.1118.

RESULTS

The smoking status (never/current) of the subjects was signifi-cantly associated with that of their spouses (p = 0.001) (Table 1). Among both men and women, smokers were more likely to be younger and to have higher alcohol consumption than nonsmokers. The mean age of subjects with spouses who smoked was younger than that of those with nonsmoking spouses; however, alcohol consumption was independent of the spouses’ smoking status (result not shown).

As for nonsmoking men, there were no significant differ-ences in nutrient intakes and participation rates in cancer screening between those with smoking and nonsmoking wives (Table 2). Among nonsmoking women, we found significantly lower intakes of fiber, calcium, carotene, vitamin B1, vita-min B2, vitamin E and lower participation rate in stomach can-cer screening in those with husbands who smoked than in those with nonsmoking husbands.

However, among men who smoked, fiber, calcium, carotene, vitamin B1, vitamin B2 and vitamin E intakes in those
Table 1. Number of pairs classified by subjects' and their spouses' smoking status.

| Wives' smoking status | Husbands' smoking status | Never | Current | Past | Total |
|-----------------------|--------------------------|-------|---------|------|-------|
| Never                 | 524                      | 26    | 8       | 558  |
| Current               | 1454                     | 269   | 58      | 1781 |
| Past                  | 630                      | 39    | 31      | 700  |
| Total                 | 2608                     | 334   | 97      | 3039 |

a) : X²-test for the association between husbands' and wives' smoking status (never and current only).

Table 2. Comparison of nutrient intake and participation in cancer screening within the past three years for never smokers according to their spouses' smoking status.

| Never smokers | Men living with | Women living with | | | |
|---------------|-----------------|-------------------|--------|--------|--------|
|               | Non-smoking wife | Smoking wife | p | Non-smoking husband | Smoking husband | p |
| Nutrient intakes a) | (n=524) | (n=26) | 0.1395 | 2259 | 2258 | 0.9912 |
| Energy(kcal) | 2761 | 2534 | | 2259 | 2258 | 0.9912 |
| Fiber(g/1000kcal) | 2.00 | 2.11 | 0.3787 | 2.40 | 2.32 | 0.0439 * |
| Calcium(mg/1000kcal) | 276 | 267 | 0.6909 | 327 | 314 | 0.0125 * |
| Carotene(µg/1000kcal) | 1498 | 1443 | 0.7638 | 1889 | 1781 | 0.0299 * |
| Vitamin B₁(mg/1000kcal) | 0.419 | 0.412 | 0.6290 | 0.469 | 0.462 | 0.0319 * |
| Vitamin B₂(mg/1000kcal) | 0.551 | 0.534 | 0.5841 | 0.604 | 0.587 | 0.0393 * |
| Vitamin C(mg/1000kcal) | 45.9 | 48.7 | 0.5435 | 54.1 | 53.5 | 0.6708 |
| Vitamin E(mg/1000kcal) | 3.32 | 3.15 | 0.3048 | 3.86 | 3.75 | 0.0102 * |

Type of cancer screening b) c) | (n=420) | (n=22) | (n=359) | (n=902) | |
| Stomach | 0.55 | 0.43 | 0.5469 | 0.48 | 0.41 | 0.0035 ** |
| Lung | 0.84 | 0.77 | 0.6330 | 0.85 | 0.81 | 0.2027 |

a) : Figures for energy are means adjusted for subjects' age, body mass index and alcohol consumption.
   Figures for the other nutrients without energy are means adjusted for subjects' age, energy intake and alcohol consumption.
b) : Subjects were older than 43 years.
c) : Figures are participation rates adjusted for subjects' age and alcohol consumption.
* p<0.05 ** p<0.01

with wives who also smoked were strongly significantly lower than in those with nonsmoking wives (Table 3). Similarly, those with wives who also smoked were significantly less likely to undergo screening for both stomach and lung cancer than those with nonsmoking wives. As for women who smoked, there were also significant differences in energy and fiber intake between female smokers with nonsmoking husbands and those with husbands who smoked. There were no significant differences in participation rates in cancer screening between female smoker groups divided by their husbands' smoking status.

When we compared the lifestyles of smokers and nonsmokers after separating them by their spouses' smoking status, the following variables were statistically significantly lower in smokers than in nonsmokers, irrespective of sex (p < 0.05): (1) intakes of fiber, calcium, carotene, vitamin B₁, vitamin B₂, vitamin C and Vitamin E among male smokers with nonsmoking wives, (2) intakes of fiber, calcium, carotene, vitamin B₁ and vitamin C among male smokers with wives who also smoked, (3) intakes of energy and vitamin B₂ among female smokers with nonsmoking husbands, (4) intakes of fiber, calcium, carotene, vitamin B₁, vitamin C and Vitamin E among female smokers with husbands who also smoked and (5) participation rates in both stomach and lung cancer screening pro-
Table 3. Comparison of nutrient intake and participation in cancer screening within the past three years for current smokers according to their spouses' smoking status.

| Current smokers       | Men living with |          | Women living with |          |
|-----------------------|-----------------|----------|-------------------|----------|
|                       | Nonsmoking wife | Smoking wife | p       | Nonsmoking husband | Smoking husband | p       |
| Nutrient intakes a)   | (n=1454)        | (n=269)  | 0.4117            | (n=26)   | 0.0323 *          |
| Energy (kcal)         | 2706            | 2661     |                   | 1797     | 2175              |
| Fiber (g/1000kcal)    | 1.86            | 1.76     | 0.0047 **         | 2.37     | 2.17              | 0.0390 * |
| Calcium (mg/1000kcal) | 248             | 232      | 0.0016 **         | 292      | 299               | 0.7996  |
| Carotene (μg/1000kcal)| 1354            | 1200     | 0.0018 **         | 1645     | 1632              | 0.7777  |
| Vitamin B1 (mg/1000kcal) | 0.403     | 0.393   | 0.0266 *          | 0.438    | 0.448             | 0.5541  |
| Vitamin B2 (mg/1000kcal) | 0.507     | 0.481   | 0.0028 **         | 0.565    | 0.573             | 0.9362  |
| Vitamin C (mg/1000kcal)| 41.0        | 39.3    | 0.2468            | 53.6     | 50.1              | 0.3350  |
| Vitamin E (mg/1000kcal)| 3.13        | 3.02    | 0.0254 *          | 3.53     | 3.59              | 0.9642  |

Type of cancer screening b) c) (n=1091) | (n=176) | 0.0009 *** | 0.24 | 0.31 | 0.8798 |
| Stomach                | 0.50 | 0.38 |                   | 0.59 | 0.75 | 0.8795 |
| Lung                   | 0.80 | 0.73 | 0.0036 **         |       |       |         |

a) : Figures for energy are means adjusted for subjects' age, body mass index and alcohol consumption.
Figures for the other nutrients without energy are means adjusted for subjects' age, energy intake and alcohol consumption.
b) : Subjects were older than 43 years.
c) : Figures are participation rates adjusted for subjects' age and alcohol consumption.
*p<0.05 ** p<0.01

The results of this study confirm our hypothesis that an individual's health-related lifestyle (nutrient intakes and participation in cancer screening) is considerably affected by his/her spouse's smoking status, although subject's own smoking habit exerted a greater influence than did those of his/her spouse. In agreement with a previous report, we also found an association between the smoking habits of couples 19).

The influence of the spouse's smoking habits was particularly apparent among male smokers, however the influence was hardly seen in female smokers. Previous studies have found that a spouse's smoking status has a major impact on their partner in terms of passive smoking and undesirable health behavior 20), possibly because of the greater social control provided by marriage, especially for men 6). The poor health-related behavior of male smokers might be increased if their wives also smoke, while the lifestyles of smoking female smokers might be less affected by their husbands' smoking habits. Smokers with spouses who also smoke are exposed to increased amounts of physically hazardous substances due to their own smoking and passive inhalation of their spouses' tobacco smoke 1,8, irrespective of sex. High levels of environmental tobacco smoke can cause DNA to become more susceptible to oxidation 1,8 and lead to cancer 12,13). The poor cancer screening participation rate found in male smokers during this study may mean that such cancers are not detected until they have become advanced.

The influence of spouses' smoking habits on the lifestyles of nonsmoking men and female smokers was less clear than in previous studies 8). This may have arisen because of the small numbers of nonsmoking men with wives who smoked and of female smokers with nonsmoking husbands included in our study, or because of differences in their behavioral characteristics.

One possible defect of this study was that other factors, such as socioeconomic status (family income and individual occupation) 3,6,21), were not analyzed. A second possibility was that some past and current smokers were misclassified as never having smoked, because we classified smoking categories only by self-reports. Lee et al. showed that Japanese women are more likely to report themselves as nonsmokers 18, thus, these misclassifications are most likely to apply to women. Correction of any misclassifications in categories grouped by the woman's smoking status would have made the differences in nutrient intakes and cancer screening participation rates more obvious because the number of nonsmoking men with wives who smoked (female smokers with nonsmoking husbands) would have increased and the discrepancies in these...
behavior patterns would have become larger.

We consider our results to be reliable because this research covered approximately 85% of adults over 35 years old living in one city, and excluded those who had positive medical histories and a history of past smoking. Moreover, we examined the validity of the food consumption questionnaire and determined rank correlation coefficients between the main questionnaire and each of the confirmatory surveys for every nutrient included (shown in the "subjects and methods" section). These correlation coefficients were almost identical to those reported previously 22.

In conclusion, we found a relationship between undesirable aspects of individuals' lifestyles (such as lower nutrient intake and participation in medical screening) and their spouses' smoking habits. In particular, poor health-related behavior in male smokers might be enhanced by living with a wife who also smokes. These results could be useful for public health nurses and other staffs engaging in disease prevention in improving residents' lifestyle in the community.

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