



ORIGINAL ARTICLE

# Intake Trends of Red Meat, Alcohol, and Fruits and Vegetables as Cancer-Related Dietary Factors from 1998 to 2009

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**Abstract**

**Objectives:** Cancer is the leading cause of death worldwide, and cancer incidence and mortality have been increasing steadily in South Korea. This study aimed to examine the change in consumption of three cancer-related dietary factors—red meat, alcohol, and fruits/vegetables, and to evaluate consumption of these dietary factors among Koreans according to the criteria from the recommendations of the World Cancer Research Fund/American Institute of Cancer Research.

**Methods:** Consumption of red meat, alcoholic beverages, and fruits and vegetables was calculated from the 24-hour recall data of 36,486 individuals older than 20 years who were selected from the Korea National Health and Nutrition Examination Survey 1998–2009. The intake adequacy of these three factors was evaluated by the recommended criteria of the World Cancer Research Fund/American Institute of Cancer Research report.

**Results:** The mean red meat intake in the men in their 20s increased sharply (from 91.6 g to 111.3 g,  $p < 0.05$ ). The mean alcohol intake increased continuously in men (from 10.3 g to 20.0 g,  $p < 0.05$ ) and women (from 1.5 g to 3.5 g,  $p < 0.05$ ). The mean fruit/vegetable intake decreased in the 21–29-year age group (from 349.4 g to 306.7 g in men; from 393.3 g to 292.5 g in women;  $p < 0.05$ ). The percentage of individuals who did not meet the intake criteria for the three cancer-related dietary factors was especially high, and the percentage increased over 10 years in those in their 20s ( $p < 0.05$ ).

**Conclusion:** We confirmed that intakes of red meat, alcoholic drink, and fruits and vegetables have moved toward a negative direction in both men and women in their 20s.

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## 1. Introduction

Prevention of cancer is one of the most pressing challenges faced by researchers and public health policy makers. Cancer is, however, preventable through modification of lifestyle and diet and by increasing physical activity. The World Cancer Research Fund (WCRF) and the American Institute for Cancer Research (AICR) published the report “Food, Nutrition and the Prevention of Cancer: a Global Perspective” in 2007 [1]. The purpose of this report was to review all the relevant research to suggest comprehensive recommendations for food, nutrition, and physical activity to prevent cancer. In this report, 10 dietary and physical activity recommendations for cancer prevention were established, and six out of these 10 recommendations are concerned with dietary factors: (1) limit consumption of energy-dense foods and avoid sugary drinks; (2) eat mostly foods of plant origin; (3) limit intake of red meat and avoid processed meat; (4) limit intake of alcoholic drinks; (5) limit consumption of salt and avoid moldy cereals (grains) or pulses (legumes); and (6) aim to meet nutritional needs through diet alone.

Cancer is the leading cause of death worldwide, and cancer incidence and mortality have been increasing steadily in South Korea [2]. According to Globocan 2012, the incidence of all cancers is expected to increase up to 25% in South Korea by 2020 [3]. Meanwhile, the dietary habits of Koreans may contribute to both protective factors against cancer and risk factors for cancer. In general, Koreans consume a great deal of vegetable dishes, such as salads and seasoned vegetables, which are known through case-control and cohort studies to be protective factors for colorectal cancer [4–7]. Meta-analyses have reported that beans and soybean products such as soybean paste, tofu, and soy milk reduce breast cancer risk [8–10]; these foods are frequently consumed in Korea. By contrast, barbecued meats, especially those barbecued with charcoal, are very popular in Korea and significantly increase gastric cancer risk [11]. Traditional Korean salted foods such as salted fish and salted vegetables have been reported as risk factors for gastric cancer [12,13]. Koreans usually consume a large amount of salted vegetables such as kimchi.

In many studies, it has been found that food consumption patterns are different by age groups and sex. Bezerra et al [14] recently found differences in food intake by sex and age groups in a study comparing food intakes in Brazil and the United States. Differences in food consumption pattern by age groups and sex were found in Canada and Lebanon as well [15,16]. In Taiwan and Spain, food consumption was different by age groups [17,18]. In a cohort of young Brazilian adults, Arruda et al [19] found that sex is associated with the dietary pattern. Considering these differences, consumption patterns of cancer-related dietary factors

would also be different by age groups and sex. Therefore, it seems meaningful to evaluate the consumption of cancer-related dietary factors for Koreans in order to monitor risk groups for cancer prevention.

In this study, we examined the change in consumption of cancer-related dietary factors—red meat, alcohol, and fruits and vegetables—and evaluated the consumption of these dietary factors according to the criteria from the recommendations of WCRF/AICR in Koreans, by comparing data from the first to the fourth Korea National Health and Nutrition Examination Survey (KNHANES).

## 2. Materials and methods

### 2.1. Dataset for analysis

The intake levels of the selected factors were analyzed in the 1998, 2001, 2005, and 2007–2009 KNHANES, which is the national monitoring survey of South Korea (a cross-sectional study). The KNHANES has been conducted with individuals selected by representative sampling of the household registries in the National Census Registry since 1998. The KNHANES data have three components: a health interview, a health examination, and a nutrition component. In this study, we used 1-day 24-hour recall data from the nutrition survey in the KNHANES to calculate and evaluate the consumption of the selected cancer-related dietary factors. We selected participants who were over 21 years of age in the KNHANES, since the intake criteria from the recommendations of the WCRF/AICR report were applicable to adults older than 21 years.

### 2.2. Selection of cancer-related dietary factors and calculation of intake of cancer-related dietary factors

Three cancer-related dietary factors—red meat, alcohol, and fruits and vegetables—which could be analyzed quantitatively using the KNHANES data were selected to evaluate the consumption of cancer-related dietary factors. This is because only these three dietary factors have recommended intake criteria, although the associations between > 40 dietary factors and cancer were reviewed by panels in the WCRF/AICR report. This is due to the difficulty in determining the intake criteria for all cancer-related dietary factors because of an insufficient number of reliable studies. Sodium intake, one of the cancer-related dietary factors in the WCRF/AICR report, was excluded from this study because the average of the sodium intake of Koreans has exceeded the recommended limit of 2,400 mg/d; therefore, the evaluation of sodium intake in Koreans seemed meaningless. Ultimately, only three cancer-related dietary factors with the intake criteria—red meat, alcohol,

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