Association of Body Mass Index with Oral Cancer Risk

Sung-Weon Choi*, Jong-Ho Lee2*, Joo-Yong Park, Young Mi Yun1, Mi Kyung Kim1

Oral Oncology Clinic, 1Cancer Epidemiology Branch, Research Institute and Hospital, National Cancer Center, 2Department of Oral and Maxillofacial Surgery and Dental Research Institute, College of Dentistry, Seoul National University

Abstract

**Purpose:** Although obesity is a well-established risk factor for many cancers, the effect of body mass index (BMI) on oral cancer risk remains controversial. We therefore investigated the effect of BMI on oral cancer risk in a case-control study in Korea.

**Methods:** Overall, 364 patients with oral cancer and 439 community controls were enrolled. Odds ratios (OR) and 95% confidence intervals (CI) were estimated using logistic regression models, adjusted for age, smoking status and alcohol consumption.

**Results:** We found no overall significant evidence of an association between oral cancer risk and BMI in either gender. However, when the relationship between BMI and oral cancer risk was examined according to female age groups (<50 and ≥50 years), there was a significant association between oral cancer risk and high BMI in female subjects younger than 50 years of age (OR=3.92, 95% CI 1.03–14.9, P for trend=0.04), but not in older (≥50 years) female subjects (OR=1.11, 95% CI 0.55–2.24, P for trend=0.76). There was no significant relationship between BMI and oral cancer risk in any of the male age subgroups.

**Conclusion:** Our study provides the first epidemiological evidence supporting an association between obesity and an increased risk of oral cancer.

**Key words:** Oral cancer, Obesity, Body mass index

Introduction

Obesity has become one of the major risk factors for cancer and one of the leading causes of death in Western and Asian countries[1–4]. World Cancer Research Fund (WCRF) and the International Agency for Research on Cancer provided evidence that obesity is causally linked to cancer of the colorectum, breast, pancreas, endometrium, kidney, and esophagus[5,6]. However, little evidence regarding the relationship between obesity and oral cancer (including precancerous lesions) is available, and the study results have thus far been inconsistent. Although some populations exhibit an inverse relationship between body mass index (BMI) and oral cancer risk as well as the premalignancy of oral cancer, other populations do not showed correlation between BMI and oral cancer risk because the prevalence and degree...
of obesity among populations differs and the association between obesity and oral cancer risk may differ between gender[7-12]. There is sufficient evidence to indicate that the use and abuse of tobacco is a major cause of oral cancer on a global scale[13-18].

Currently, incidence of oral cancer is increasing in non-smoker group including young age woman. Nevertheless, risk factors for oral cancer among non-smokers and non-drinkers, primarily among women, have not been well established. The etiologic factors of oral cancer in women may be different from men because the majority of female oral cancer patients are non-smokers[19-24]. Although Human papillomatous virus (HPV) plays an important role in oropharyngela cancer, HPV is not main etiologic factor for nonsmoker groups in oral cancer patients. Above mentioned, it has been reported that excess body weight may be a major risk factor for cancers. Unfortunately, the percentage of obese adults has greatly increased worldwide. Taken together, the percentage of adults with overweights was also increasing in Korea.

We hypothesized that overweight is a risk factor for oral cancer among the non-smokers. In our study, a case-control study was conducted to assess the relationship between BMI and oral cancer risk in the Korean population.

Materials and Methods

1. Study subjects

Patients with oral cavity and oropharyngeal cancers (Codes C00~C06 of the International Classification of Disease, Tenth Revision), henceforth referred to as oral cancer, were recruited at the National Cancer Center (NCC) and the Seoul National University Dental Hospital (SNUDH) in Korea between 2004 and 2006. Three hundred sixty-four cases (242 men, 122 women) with an initial histopathologic diagnosis of oral squamous cell carcinoma were selected. Subjects ranged in age from 20- to 80-years-old. Community-based cancer-free control subjects were randomly selected during the same study period, and were frequency matched to case distributions according to gender, age (±5 years), and residential region. Thus, a total of 364 cases and 439 community control participants were included in this study. Informed consent was obtained from all subjects after a full explanation of the study, which was approved by the institutional review boards of the Korea National Cancer Center.

2. Exposure assessment

All subjects were interviewed by individuals trained to adhere to institutional guidelines for studies including human subjects. Information was collected using a structured questionnaire on socio-demographic characteristics, smoking, and drinking history. Self-reported height and weight were collected at diagnosis. Subjects were measured only if they did not know their height and weight. Self-reported height and weight were also categorized into tertiles for analyses based on the distribution of each value among control subjects using the highest tertile as the reference category. BMI (kg/m^2), computed as weight in kilograms divided by the square of the height in meters, was categorized using the World Health Organization definition of obesity for Asians (underweight: <18.5 kg/m^2, normal weight: 18.5 to 23 kg/m^2, overweight: 23 to 25 kg/m^2, obesity: >25 kg/m^2)[25]. Because the number of underweight subjects was small in this study, we merged underweight (<18.5 kg/m^2) and normal weight (18.5 to 23 kg/m^2) categories into one normal weight group. Habitual cigarette smoking was defined as having smoked at least once a week for more than 1 year. Similarly, habitual alcohol drinking was defined as consuming any alcoholic beverage at least once a week for more than 1 year. Details on the duration and amount of smoking and alcohol consumption were obtained.

3. Statistical analysis

The mean values and standard deviations were calculated for continuous demographic variables, and the mean differences were tested by t-test or ANCOVA (age-adjusted). Distributions in cigarette smoking and alcohol drinking status among cases and control groups were evaluated using the χ^2 test. Unconditional logistic regression models were used to estimate crude and multivariate odds ratios (ORs) and corresponding 95% confidence intervals (CI)[26]. Risk estimates were computed with multivariate adjustments for age, smoking habits (ever versus never), and alcohol consumption (ever versus never). Tests for linear trends were calculated by treating the categories as