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Original Research

Fermented food intake is associated with a reduced likelihood of atopic dermatitis in an adult population (Korean National Health and Nutrition Examination Survey 2012-2013)

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ABSTRACT

The prevalence of atopic dermatitis (AD) has continuously increased throughout the world in every age group, and the recent increase in AD in Korean adults may be related to changes in nutrient intakes due to westernization of dietary patterns. We hypothesized that the prevalence of AD is associated with the different dietary patterns and fermented food intakes of the Korean adult population. We examined the hypothesis using 9763 adults 19 years or older using the 2012-2013 Korean National Health and Nutrition Examination Survey. We identified 4 dietary patterns in addition to that including fermented foods using principal component analysis on data obtained from a 116-item validated semiquantitative food frequency questionnaire: meat and processed foods; vegetables, fruits, legumes, seafood, and seaweed; rice and grains; and coffee, chocolate, and ice cream. Adjusted odds ratios (ORs) for AD were calculated according to dietary patterns after adjusting for potential confounders. High levels of consumption (>92 times/month) of fermented foods such as doenjang, chungkookjang, kimchi, fermented seafood, makgeolli, and beer were associated with a lower prevalence of AD (OR, 0.56; 95% confidence interval [CI], 0.37-0.84). In contrast, high levels of consumption of meat and processed foods were strongly associated with the prevalence of AD (OR, 2.42; 95% CI, 1.48-3.94). Interestingly, the consumption of coffee, chocolate, and ice cream was significantly negatively associated with the prevalence of AD (OR, 0.53; 95% CI, 0.34-0.82). In conclusion, the hypothesis was accepted. The results can be applied to nutrition education programs for the general population to decrease risk factors for AD.

Abbreviations: AD, atopic dermatitis; BMI, body mass index; CC, coffee, chocolate, and ice cream; CI, confidence interval; FF, fermented foods; IL, interleukin; KNHANES, Korean National Health and Nutrition Examination Survey; MP, meat and processed foods; OR, odds ratio; RG, rice and grains; Th, T-helper cell; VF, vegetables, fruits, legumes, seafoods, and seaweeds.

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1. Introduction

Atopic dermatitis (AD) is more common in infants and children than in adults (approximately 20% vs 3%-6% prevalence in the United States) [1]. There are also ethnic differences in the prevalence of AD, and it occurred in approximately 2.5% of Korean adults during 2008 to 2010, which was greater than 30 years ago [2]. However, the prevalence of AD has continuously increased throughout the world in every age group, even in adults in industrialized countries, including Korea [3]. Its increase might also be associated with dietary patterns due to industrialization. The etiology of AD remains unknown, but it is related to immune dysfunction and epidermal barrier dysfunction [1,4]. Especially, in infants, AD is related to the immature intestinal and skin barriers, and certain foods act as antigens to activate unnecessary immune response [1]. Even in adults, certain foods and environmental factors induce overreactive immune responses, although intestinal barriers are intact and their overactivation by various mechanisms may be associated with AD in adults [4].

Many studies have been conducted in infants, children, and adults that evaluate allergenic foods and environmental factors, but the aggravating and reliving factors remain controversial [4-7]. Therefore, it is important to examine AD risk factors and preventive measures for AD especially in adults. The use of probiotics, mainly *Lactobacillus* species, has demonstrated preventive effects on the development of AD in infants [5], children [6], and adults [7]. According to a meta-analysis of 6 randomized clinical trials of infants, the combined risk ratio of the prevalence of AD associated with the long-term use of supplementary probiotics was 0.86 (95% confidence interval [CI], 0.77-0.96) compared with the placebo control [7]. In addition, a double-blinded, randomized clinical trial with adult AD patients demonstrate that the consumption of heat-killed *Lactobacillus acidophilus* strain L-92 decreased the incidence of skin lesions and eosinophil counts in comparison to the consumption of placebo. These results suggest that *L acidophilus* strain L-92 is effective for AD symptoms in adult patients [7]. Thus, the use of probiotics is likely to have long-term preventive effects on AD even in adults.

However, the effect of fermented foods (FF) on AD has not been studied in randomized clinical trials, although a beneficial effect has been reported in experimental animal models [8,9]. Kimchi contains several strains of *Lactobacillus plantarum*, some of which were shown to suppress AD-like skin lesions and epidermal thickening, with decreased serum immunoglobulin E levels and T-helper cell (Th)–producing cytokines, in house dust mite–induced dermatitis in NC/Nga mice [10]. In addition, treatment with chungkookjang, a Korean fermented soy food, has been demonstrated to reduce ear thickness, dermis thickness, auricular lymph node weight, and infiltration of mast cells in IL-4/Luc/CNS-1 transgenic mice with AD-like symptoms [9]. Thus, FF may play an important role in preventing AD. Koreans have traditionally consumed various FF such as chungkookjang, deonjang, kochjang, kimchi, and pickled vegetables, but consumption of these foods has decreased in the last decade. Therefore, the decreased consumption of FF may be associated with the increased prevalence of AD. In addition to the consumption of FF, the westernization of food intake, such as increased consumption of meats and processed foods (MP) and decreased consumption of rice and grains (RG), may affect the prevalence of AD.

We hypothesized that the prevalence of AD is associated with the different dietary patterns and consumptions of FF in the Korean adult population. We tested the hypothesis independent of potential confounding factors, in adults 19 years or older using data from the 2012-2013 Korean National Health and Nutrition Examination Survey (KNHANES), a large South Korean population-level study based on a stratified multistage probability sampling design.

2. Methods and materials

2.1. Data collection

2.1.1. Data and participants

This study used data from the 2-year KNHANES conducted from 2012 to 2013, which was obtained from KNHANES V (2012) and KNHANES VI (2013). KNHANES is conducted annually using a rolling sampling design that involves a complex, stratified, multistage, probability-cluster survey of a representative sample of the civilian population in South Korea [11]. The survey is performed by the Korean Centers for Disease Control and Prevention and the Korean Ministry of Health and Welfare, and it has 3 components: health interviews, health examinations, and nutrition surveys [12]. The Institutional Review Board of the Korean Centers for Disease Control and Prevention and the Keimyung University Institutional Review Board reviewed and approved the survey (approval nos. 2012-01EXP-01-2C, 2013-07CON-03-4C, 2013-12EXP-03-5C, and 2015-01-HR-05-01) [13]. The study was carried out in accordance with the recommendations for strengthening the reporting of observational studies in epidemiology statement [14]. The present cross-sectional analysis was restricted to participants aged 19 years or older who completed the health examination and the nutrition survey (n = 9763; 3875 men and 5888 women). Information regarding age, educational level, income, residential area, smoking history, and alcohol consumption was collected during the health interview according to the KNHANES manual [12].

2.1.2. Variables for general information of participants

Age was categorized into 2 groups (19-50 and 51-65 years). Educational level was categorized into 3 groups: less than high school, high school, and college or more. Height and weight measurements were performed with the participants wearing light clothing without shoes. Body mass index (BMI) was calculated as weight (in kilograms) divided by the square of height (in meters). Waist circumference was measured midway between the costal margin and the iliac crest at the end of normal expiration [12]. Participants were categorized into 3 groups according to the obesity references for Asian populations [13]: lean (BMI <18.5), normal (18.5 ≤ BMI < 25),