

Dietary pattern, nutritional density, and dietary quality were low in patients with cerebral infarction in Korea[☆]

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Received 24 September 2010; revised 9 July 2011; accepted 3 August 2011

Abstract

The aim of this study was to examine if the dietary quality of patients with cerebral infarction (CI) was comparatively worse than those of non-CI subjects in Korea. This case-control study included 146 subjects recruited between May and July 2007 from Kyung Hee University Medical Center (Seoul, Korea). The eating habits, nutritional adequacies, dietary patterns, and overall dietary quality of the subjects were investigated. Patients with CI more frequently skipped meals, had more irregular meal times, and preferred saltier and spicier foods than non-CI subjects. Nutritional densities (vitamin C, vitamin B₁, vitamin B₂, folate, and calcium) and overall dietary quality measures of CI subjects were lower than for non-CI subjects. Frequencies in omission of food groups, particularly the fruit and dairy groups, and the number of food items consumed daily by CI subjects were significantly lower than non-CI subjects ($P < .01$). After controlling for age, sex, disease, and other health-related factors, high dietary quality scores, especially the variety and adequacy components (desirable diet patterns and quality) had a lower CI incidence ($P < .05$). In conclusion, we found that Korean patients with CI had a comparatively worse diet quality. Therefore, we suggest active medical nutrition therapy for patients with CI in clinical settings to manage diet quality.

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Keywords:

Cerebral infarction; Dietary pattern; Nutritional density; Eating habits; Dietary quality; Korean; Humans

Abbreviations:

BMI, body mass index; BP, blood pressure; CI, cerebral infarction; DDS, dietary diversity score; DMGFV, dairy (D), meat (M), grain (G), fruit (F), and vegetable (V); DQI-I, diet quality index-international; DVS, dietary variety score; KDRI, dietary reference intake for Koreans; MAR, mean adequacy ratio; NAR, nutrient adequacy ratio.

1. Introduction

According to the World Health Organization, stroke and other cerebrovascular diseases are the second highest causes of mortality worldwide at 9.7% of the total mortality rate [1]. In Korea, cerebrovascular disease is responsible for 12.0% of mortality [2], which is higher than the rest of the

world. Cerebral infarction (CI) has a 4 times higher incidence rate than cerebral hemorrhage, yet previous studies have not focused on the analysis of diet, nutrition, or dietary risk factors that may be related to CI [3–10]. A number of foods or nutrients, such as long-chain polyunsaturated fatty acids [4], fruits [6], vegetables [6], and whole grains [9], have been demonstrated to be associated with reduced risk of CI. In addition, a low intake of potassium [3], a high intake of sodium [10], and an insufficient dietary fiber consumption [8] are positively related to CI occurrence. Because foods and nutrients are combined together, their cumulative effects on disease risk may be best investigated by considering the overall dietary pattern [5]. Therefore, an analysis of dietary patterns is important to determine the

[☆] This work was supported by a grant from the Kyung Hee University Post-Doctoral fellowship in 2009 (KHU-20090455).

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combined effects of foods on the occurrence of CI in a Korean population.

A previous study [11] found that the Western dietary pattern, characterized by high intakes of red and processed meats, refined grains, high-fat dairy products, and sweets and desserts, is associated with an increased risk of stroke, especially CI. Conversely, reduced risk for CI has been associated with a prudent dietary pattern (a diet higher in fruits and vegetables, fish, and whole grains) [11].

Analysis of the dietary characteristics of Koreans demonstrated that the typical consumption of sodium is 3 times greater than the adequate amount (1.5 g per day) [7]. Furthermore, 82.9% of Koreans consumed more than 2 g of sodium per day, which is the daily sodium intake goal and the level suggested by World Health Organization/Food and Agriculture organization of the United Nations (FAO) for the prevention of diet-related chronic diseases [7]. Therefore, Koreans consume 1000 mg more sodium than individuals in the United States [12]. Moreover, the total fat intake in Korea increased significantly from 7.2% of total calories in 1969 to 18.5% in 2007, which is associated with an increase in animal fat consumption [7]. Changing the total fat intake is believed to have influenced the recent increases in obesity and chronic diseases in Korea [2].

Koreans have several dietary risks for CI; however, few studies have investigated Korean dietary patterns. We hypothesized that Korean dietary patterns and quality before CI onset were relatively poor, including less diverse and varied meals, excesses of sodium, and insufficient potassium and dietary fiber. In addition, the objective of this study was to identify the dietary characteristics of Korean patients with CI by comparing the dietary patterns and quality between patients with CI and non-CI subjects.

2. Methods and materials

2.1. Subjects and study design

This case-control study included 146 subjects recruited from the Kyung Hee University Medical Center (Seoul, Korea) between May and July 2007, which included 73 patients with CI and 73 age- and sex-matched non-CI patients. To be eligible for the study, non-CI subjects had to present stable vital signs, no history of CI or stroke, no presence of other neurologic disease (eg, Parkinson disease, dementia, and paralysis), and should not be using antidepressant medication. The diagnosis of CI was confirmed by brain computed tomography or brain magnetic resonance imaging. We investigated only subjects who were first diagnosed at this time and showing stable signs in this study (mean post-CI delay, 17.2 days). We included only patients with normal Mini-Mental State Examination test scores (score ≥ 25 points [of 30]) [13]. The CI group was allowed to continue with general treatments, such as rehabilitation and medications, because this study was conducted without providing any medical treatment. All subjects provided informed consent for participation. The research protocol was approved by the

Institutional Review Board of the Kyung Hee University Medical Center (Seoul, Korea).

2.2. General and anthropometric measurements

Data regarding participant characteristics, including sex, age, family history of stroke, diseases, and health-related behaviors, were collected by experienced interviewers. Body mass index (BMI) was calculated as body weight (kg)/height squared (m^2). Trained nurses measured patient blood pressure (BP) twice in the supine position after a 10 minute rest period using a mercury sphygmomanometer (HM-1101; HICO, Tokyo, Japan).

2.3. Eating habits and intake measurements

A survey was conducted to assess the eating habits of participants during the year before CI onset. The questionnaire included frequency of skipped meals, regularity of meals, degree of chewing, frequency of eating out, and taste preferences. In addition, the modified semiquantitative food frequency questionnaire of the Korean Health and Nutrition Examination Survey 2005 [14] was used in the present study. The semiquantitative food frequency questionnaire is composed of 85 food items. All food-item questions were asked during a one-on-one interview, which included food models and measuring instruments for estimating portion sizes. Nutrient intake was assessed using CAN Pro version 3.0 (Computer-Aided Nutritional Analysis Program, The Korean Nutrition Society, 2006).

2.4. Assessments of nutritional adequacy

Energy and intake of 15 nutrients were compared with the Dietary Reference Intakes for Koreans (KDRI) [15], which vary by age and sex. Nutrient scores were assigned based on the percentage attainment of the KDRI on a continuous scale. Energy was calculated based on the estimated energy requirements. Protein, calcium, phosphorus, iron, zinc, vitamin A, vitamin B₁, vitamin B₂, vitamin B₆, niacin, vitamin C, and folate were calculated based on the recommended intake levels of the KDRI. Dietary fiber, potassium, and vitamin E were calculated using the adequate intake levels according to the KDRI [15].

The nutrient adequacy ratio (NAR) was calculated from the daily average nutrient intake of the subjects according to the following equation, and values greater than 1 were expressed as 1 to identify individuals with greater nutrient intakes [16]. Nutritional adequacy, a major aspect of overall dietary quality, was measured using the average NAR value of all assessed nutrients, that is, mean adequacy ratio (MAR) [16,17].

The formula for the NAR is

$$\text{NAR} = \frac{\text{the subject's daily intake of a specific nutrient}}{\text{the KDRI of that nutrient}}$$

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