In Korea, with the rapid aging of the population, functional disability is becoming an important public health issue (1). Disabled elderly persons are at an increased risk of functional decline, falls and injury, nursing home placement, and mortality (2-5).

A systematic literature review identified nutritional status as one of the key risk factors for functional limitations and disability (6). Poor nutritional status has been found to increase the risk of functional impairment and disability in community-dwelling older adults (7).

The associations between diet and disability have been studied using nutritional risk screening tools (8-10) and nutrient intakes (11-13). However, few studies have examined the association of dietary factors with disability, with inconsistent findings being reported (14,15). Moreover, most studies have been conducted in North America and Europe, and the results may not apply to the Korean population whose dietary habits are different from those in western countries. Little is known about the role of diet on disability in elderly Koreans.

Milk and milk products are rich in calcium and previous studies suggested that there may be an association between functional disability and calcium through its role in bone health, such as bone structure and function, peak bone mass, osteoporosis, and osteoporosis-related fractures (16-19). The purpose of this study was to examine the association between frequencies of milk and milk products consumption and functional disability in the Korean elderly, using a population-based survey data.

**Methods**

This study was based on data obtained from the 2005 Korea National Health and Nutrition Examination Survey (KNHANES) of non-institutionalized civilians in the Republic of Korea. Details of the survey design are described elsewhere (20). Briefly, this survey is a nationwide representative study using a stratified, multistage probability sampling design for the selection of household units. Written informed consent was obtained from all participants.

The survey consisted of four parts: the Health Interview Survey, Health Behavior Survey, Health Examination Survey, and Nutrition Survey. A total of 3,730 aged 65 and older was completed in the health interview survey and one third of them was examined in other surveys. 935 (373 men, 562 women) aged 65 and older were identified as potential subjects in our study, with physical functioning status, nutritional survey data, and self response. We excluded those with incomplete data for the marital status (1 men), income (4 women), smoking status/alcohol drinking/exercise (2 women), anthropometric measures (48 men, 109 women), menarche (3 women), and duration of breast feeding (21 women). This resulted in a final analytical sample of 747 (324 men, 423 women).
Dietary assessment

Participants’ usual dietary intake over the preceding year was assessed by using an interviewer-administered, food frequency questionnaire (FFQ). The FFQ consisted of 63 items of which 62 were derived from the 2001 KNHANES on information about the most frequently consumed foods stratified by gender and age, and from the 2002 Seasonal Nutrition Survey on seasonal food intake. Additionally, one item on fried food consumption frequency was included, based on the Dietary Behaviors Survey (21). Frequencies of intake were ranked in 10 categories: consumed rarely, six to eleven times a year, once a month, two to three times a month, once a week, two to three times a week, four to six times a week, once a day, two times a day, or three times a day.

We used the 57-item FFQ, excluding six foods (beer, soju (Korean distilled spirits), makgeolli (raw rice wine), hamburger, pizza, fried food) that showed low frequency of intake by the participants. Food groups consisted of the following categories: milk and milk products (milk, yoghurt, ice cream); cereals (rice, barley/multigrain, instant noodles (ramen), noodles, bread, rice cakes, sweet baked goods); legumes (tofu, beans, soy milk); potatoes (potato, sweet potato); meats (beef, chicken, pork, ham and sausage); eggs; fishes and shellfishes (mackerel, tuna, croaker, pollack, anchovy, fish cakes, squid, clams, pickled fish); vegetables (Chinese cabbage, radish, dried radish leaves, bean sprout, spinach, cucumber, hot pepper, carrots, pumpkin, cabbage, tomato); mushrooms; seaweeds (sea mustard, dried laver); and beverages (soft drinks, coffee, green tea). All frequencies were standardized into “times per day” by using the conversion factors 4.3 weeks per month and 30.4 days per month and frequency of food group consumption was summed each food item.

Frequency of food group consumption was classified into three categories (low, medium, high) based on the distribution of the participants: for men and women, milk and milk products consumption (low: < 1 time/week, medium: 1-6 times/week, high: ≥ 1 time/day); cereals and their products/vegetables (low: < 4 times/day, medium: 4-5 times/day, high: ≥ 6 times/day); potatoes and starches/eggs (low: < 2 times/month, medium: between 2-3 times/month and 1 time/week, high: ≥ 2 times/week); mushrooms (low: < 1 time/month, medium: 1-3 times/month, high: ≥ 1 time/week); seaweeds (low: < 2 time/week, medium: 2-6 times/week, high: ≥ 1 time/day); fruits (low: 3 times/week, medium: 3-6 times/week, high: ≥ 1 time/day); for men, legumes and their products (low: < 3 times/week, medium: between 3-6 times/week and 1 time/day, high: ≥ 2 times/day); meats and their products (low: < 1 time/week, medium: 1 time/week, high: ≥ 2 times/week); fish and shellfish (low: < 4 times/week, medium: 4-6 times/week, high: ≥ 1 time/day); beverages (low: < 3 times/week, medium: between 3-6 times/week and 1 time/day, high: ≥ 2 times/day); for women, legumes and their products (low: < 2 times/week, medium: between 2-6 times/week and 1 time/day, high: ≥ 2 times/day); meats and their products (low: < 2 times/month, medium: 2-3 times/month, high: ≥ 1 time/week); fish and shellfish (low: < 2 times/week, medium: 2-6 times/week, high: ≥ 1 time/day); beverages (low: < 1 time/week, medium: 1-6 times/week, high: ≥ 1 time/day).

Functional disability

Functional disability was assessed by face-to-face interview. The questionnaire identified 17 activities, and participants were asked to indicate whether they had no difficulty, some difficulty, were unable, or did not do the activities, when they were by themselves and did not have the use of aids. The 17 activities were grouped into instrumental activities of daily living (IADLs) and activities of daily living (ADLs). IADLs consisted of the following 10 activities: grooming, housework, preparing meals, doing laundry, going outside, using public transportation, shopping, managing money, using the telephone, and taking medications. ADLs consisted of the following 7 activities: dressing, washing, bathing, eating, transferring, using the toilet, and incontinence. Respondents were categorized as either not disabled (no difficulty on any activity or did not do the activity) or disabled (some difficulty or unable to do on any activity).

Covariates

Body mass index (BMI, kg/m²) was calculated by using measured weight and height. Participants were asked about their age, marital status (married, others (not married, bereavement, divorce, or separation)), education level, income, comorbidity (number of physician-diagnosed chronic conditions), and supplementary nutrient intake (any vitamin and mineral intake for more than two weeks in the past year). Income was used as equivalent income (monthly household income/√number of household members) by 5-year age group (22).

Smoking status (never, former, or current), alcohol drinking (never, former, or current), and exercise (regular exercise during leisure time) were obtained by self-report. For women, age at menarche, average duration of breast feeding, and oral contraceptive use were examined.

Statistical analysis

The characteristics of the participants were reported as mean, standard deviation (SD), or percentages. Analysis of variance (ANOVA) and chi-square test were used to analyze differences among the milk and milk products consumption groups (< 1 time/week, 1-6 times/week, ≥ 1 time/day). Odds ratios (OR) with 95% confidence intervals (CI) for the presence of functional disability, with the lowest category of frequencies of dairy consumption (< 1 time/week) as the reference group, were determined after adjustment for all covariates and frequencies of other food group consumption into three categories, using