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Trends in nutritional inequality by educational level: A case of South Korea

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ABSTRACT

Objective: There is much evidence of a cross-sectional relation between socioeconomic position and dietary intakes but the trend of this relation is little studied. This study aimed to examine the extent and trend of nutritional inequality by educational level based on the prevalence of inadequate nutrient intakes.

Methods: Three cross-sectional nationwide surveys (1998, 2001, 2005) of the Korean National Health and Nutrition Examination Survey were used. A total of 20 777 participants ≥20 y old were included. The socioeconomic position indicator was educational level. Dietary nutrient intakes were assessed by a 24-h recall and inadequacy of intake for nutrients was assessed on the basis of the percentage of attainment of the dietary reference intakes for Koreans. To assess nutritional inequality by educational level, the prevalence ratio, relative index of inequality, and slope index of inequality were used.

Results: Poorer dietary intakes and higher estimated prevalence of nutrient inadequacy were more apparent in the lower education group than the higher education group for both genders and each survey year. Graded patterns of inequalities in nutrient intakes by educational level were generally clear at each survey year. The trend of the relative nutritional inequalities in Korean men and women remained unchanged from 1998 to 2005, with some exceptions.

Conclusion: The inequality in nutrient intakes by educational level was persistently apparent for both genders in the Korean adult population, although the relative inequalities did not increase over time.

Introduction

Socioeconomic position has been one of the most powerful predictors of health status and mortality in Asian countries [1–5] and Western countries [6–8]. The difference in mortality and morbidity by socioeconomic position has been commonly explained by high risk of health behaviors including diet, smoking, and physical activity [9–11]. Specifically, the effect of poor dietary consumption on health in socially disadvantaged people has been shown in all age groups [9].

There is much evidence of a cross-sectional relation between socioeconomic position and dietary intakes [9,12,13], but studies on the trend of this relation are relatively scarce. In addition, the trend of nutritional inequality has been studied focusing on developing countries [14] and only few studies have examined the nutritional inequality by socioeconomic position in developed countries [15,16]. Given that health inequality by socioeconomic position tends to increase worldwide [17], tracking the socioeconomic nutritional inequality over time would be an important key to better understand healthy inequality as one of contributors to health inequality.

South Korea experienced an economic crisis in the midst of rapid economic growth. Since the economic crisis in 1997, the proportion of households living under the poverty threshold has dramatically increased in Korea, almost tripling from 1996 (3.1%) to 2006 (11.6%) [18]. In accordance with the situation, the increase in socioeconomic health inequality has been also found in the Korean population [4,10,19]. Identifying whether relative nutritional inequality does exist in Korea and, if so, whether it matters, would be helpful to make strategies to reduce health inequality.

Among indicators reflecting socioeconomic position, educational level has an important influence on socioeconomic position because it reflects occupation and income and is related to an ability to obtain or understand health-related information in general [20]. Several studies have shown that education is a stronger indicator in assessing socioeconomic differences than

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other indicators [12,13,21,22]. Therefore, this study aimed to examine the extent and trend of nutritional inequality based on the prevalence of inadequacy of nutrient intakes by educational level using the three cross-sectional surveys of the Korean National Health and Nutrition Examination Survey (KNHANES).

Materials and methods

Study population and data collection

Data were based on the KNHANES conducted by the Korean Institute for Health and Social Affairs, the Korea Health Industry Development Institute, and the Korean Centers for Disease Control and Prevention. The KNHANES is a cross-sectional health and nutrition survey using nationally representative samples of non-institutionalized civilian Koreans and three surveys of KNHANES (1998, 2001, 2005) were used for this study. The KNHANES consists of four parts: the health interview survey, the health behavior survey, the nutritional survey, and the health examination study. The study subjects were non-institutionalized civilians selected by a stratified multistage probability sampling design. A more detailed description of the survey procedure has been published elsewhere [23–25]. Among 37 098 survey participants, 29 310 subjects completed the nutritional survey. When subjects who completed the nutrition survey were compared with non-completers in the nutritional survey, they had a similar mean age (33.6 y for completers, 33.4 y for non-completers). Proportions of women were 52.5% for completers and 49.1% for non-completers, and education level was relatively high among non-completers (36.6% for non-completers, 45.2% for completers in middle school or less; 26.9% for non-completers, 22.3% for completers in college or higher). For the analysis, subjects who were <20 y old ($n = 8522$) and whose education information was not available ($n = 11$) were excluded. Thus, the final sample was 20 777 (7370 for 1998, 6970 for 2001, 6437 for 2005).

Dietary information

Nutritional information was collected by using a 24-h recall administered by a trained dietary interviewer in the Korea Health Industry Development Institute. A 24-h recall was based on 1-weekday food intake and the nutrients were quantified using the Database Management System (Korea Health Industry Development Institute, Seoul, Korea). For a subject's recall, supplementary tools such as food models and two-dimensional food volumes and containers were used. The detailed information has been published elsewhere [24].

Dietary nutrient intakes were assessed by energy and 11 nutrients based on dietary reference intakes for Koreans [26]. The nutritional status was represented as the percentage of attainment of the dietary reference intake, estimated energy requirement for energy, adequate intake for sodium and potassium, and recommend intake for other nutrients. The prevalence of inadequacy for nutrient intakes was examined on the basis of the estimated energy requirement for energy, acceptable macronutrient distribution range for fat, and estimated average requirements for nine other nutrients, except for potassium and sodium. The consumptions representing the estimated energy requirement or less for energy, the acceptable macronutrient distribution range <15 for fat, and the estimated average requirements or less for nine other nutrients were flagged as indicating inadequate nutritional status [27].

Socioeconomic position

Education has been reported as a stronger indicator in assessing socioeconomic differences among indicators reflecting socioeconomic position [12,13,21,22] and our data had a possibility of overestimation for income [18,28] and a substantial proportion of those who were economically inactive (54% of women and 23% of men). Thus, we used educational level for socioeconomic position in this study. Education was categorized into three groups: middle school or less (≤9 y of schooling), high school (10–12 y of schooling), and college or higher (≥13 y of schooling).

Sociodemographic and health behavior information

Sociodemographic variables included age, sex, occupation, household income, marital status, and region. Household income was measured by an open-ended question. We categorized household income level into three groups in terms of poverty line: ≤120% of poverty line, 120–250% of poverty line, and ≥250% of poverty line. Proportions of the household with an income at ≤120% of the poverty line were about 40% in 1998, 22% in 2001, and 23% in 2005, which seemed to be overestimated compared with other previous studies on poor households [18,28]. Occupation was classified into three groups (non-manual, manual, and others). Non-manual occupations included managers, professionals, technicians, and clerks. Manual occupations included service and sales workers, agricultural and fishery workers, craft and related trade workers, plant and machine operators and assemblers, and unskilled workers. Those who were not in the labor market such as unemployed, retired, students, and homemakers were categorized as others.

For other general characteristics of subjects, marital status (unmarried, living with spouse, and living without spouse [widowed/separated/divorced]), area of residency (city, urban, and rural), smoking status (current, previous, and never), drinking status (current, previous, and never), and physical exercise (yes and no in terms of four to five times/week and >30 min for moderate physical exercise) were examined.

Statistical analysis

All analyses were performed separately for men and women because of differences in dietary behavior and intakes and educational level between genders [29]. Because age is negatively related to educational level, age was included as a covariate in all statistical tests. Other socioeconomic position indicators such as occupation and income and health behaviors (smoking, alcohol consumption, and physical exercise) could be in the causal pathway between education and nutrient intakes so that adjusting for those variables may underestimate the effect of education on nutrition. Thus, these variables were not used as covariates in the model examining nutritional inequalities by educational level and its trends.

The nutrient intakes except for energy were adjusted for energy intake in the model. The difference of mean values of age by survey year and nutrient intakes by educational level were assessed using a general linear model. The age-adjusted prevalence of inadequate nutritional status for each nutrient by educational level was examined by the direct standardization method, using the total sample of the three surveys as the reference.

To assess nutritional inequality by educational level, the prevalence ratio (PR), relative index of inequality (RII), and slope index of inequality were used [30,31]. A recent study has found that, when the outcome prevalence was high and varied significantly over time, there was a discrepancy between the trend of odds ratio and PR. In this case, the PR was shown to be a more reliable relative measurement to assess the trend of socioeconomic inequality [19]. Therefore, although relative measurements commonly used in socioeconomic inequality studies are odds ratio and RII by logistic regression, in this study we used the PR and RII by log-binomial regression, using PROC GENMOD [32].

The RII has been used extensively in studies on trends in socioeconomic inequalities in health and health behaviors [3,4,19,33–36]. It measures effects that permit meaningful comparison of socioeconomic health inequalities over time [30,31,36]. For the calculation of RII, a relative educational position indicator was computed. It is a value of the relative position, which ranges from 0 to 1, in the cumulative population distribution of the central subject in each group of the educational hierarchy. The computed relative educational position indicator as an independent variable and the value for inadequate nutritional status as a dependent variable were entered in the log-binomial regression analyses. The exponential value of the regression coefficient for the relative educational position indicator is RII for inadequate nutritional status. The RII by log-binomial regression is interpreted as the PR for inadequate nutritional status between two ends of an educational hierarchy. The trend in the RII over time was estimated from the P value for an interaction term of the relative educational position indicator and survey year of the data in the model. The slope index of inequality was estimated by linear regression, with the relative educational position indicator as an independent variable and the prevalence of inadequate nutrient intakes by relative educational position as a dependent variable, using the PROC REG procedure in SAS (SAS Institute, Cary, NC, USA). It is interpreted as the absolute difference in the prevalence of inadequate nutritional status between the bottom and top of an educational hierarchy. All analyses were conducted using SAS 9.1.

Results

Table 1 lists the general characteristics of subjects over time. Income and educational level for both genders had an increasing trend over time. The proportion of subjects with a manual job (52.2–58.8% for men, 31.3–38.2% for women according to surveys) was more than twice that of subjects with a non-manual job (19.8–24.9% for men, 9.8–15.1% for women according to surveys). Most subjects were married and lived with their spouses. The proportion of residences in a city area had an increased trend. Although subjects were likely to stop smoking over time, they were more likely to drink alcohol. The level of exercise had an increased trend over time in both genders.