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Egg consumption and coronary artery calcification in asymptomatic men and women☆

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ABSTRACT

Objective: The association of egg consumption with subclinical coronary atherosclerosis remains unknown. Our aim was to examine the association between egg consumption and prevalence of coronary artery calcium (CAC).

Methods: Cross-sectional study of 23,417 asymptomatic adult men and women without a history of cardiovascular disease (CVD) or hypercholesterolemia, who underwent a health screening examination including cardiac computed tomography for CAC scoring and completed a validated food frequency questionnaire at the Kangbuk Samsung Hospital Total Healthcare Centers, South Korea (March 2011–April 2013).

Results: The prevalence of detectable CAC (CAC score > 0) was 11.2%. In multivariable-adjusted models, CAC score ratio (95% confidence interval [CI]) comparing participants eating ≥ 7 eggs/wk to those eating < 1 egg/wk was 1.80 (1.14–2.83; *P* for trend = 0.003). The multivariable CAC score ratio (95% CI) associated with an increase in consumption of 1 egg/day was 1.54 (1.11–2.14). The positive association seemed to be more pronounced among participants with low vegetable intake (*P* for interaction = 0.02) and those with high BMI (*P* for interaction = 0.05). The association was attenuated and no longer significant after further adjustment for dietary cholesterol.

Conclusion: Egg consumption was associated with an increased prevalence of subclinical coronary atherosclerosis and with a greater degree of coronary calcification in asymptomatic Korean adults, which may be mediated by dietary cholesterol. The association was particularly pronounced among individuals with low vegetable intake and those with high BMI.

☆ These authors take responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation

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1. Introduction

Eggs are a good source of protein and nutrients including folate, B vitamins, and unsaturated fatty acids [1]. Egg consumption, however, has long been a source of concern as a possible risk factor for cardiovascular disease (CVD) [2] due to their high cholesterol content and increased levels of trimethylamine N-oxide (TMAO) [3]. Eggs consumption has also been associated with increased risk of diabetes [4] However, the epidemiological evidence on the cardiovascular consequences of egg consumption is inconclusive. A meta-analysis of prospective studies suggested that egg consumption was associated with an increased risk of CVD in subjects with type 2 diabetes but not in those without diabetes [4,5]. The association of egg consumption with coronary atherosclerosis, the pathological process that underlies most clinical coronary events, remains unknown.

Coronary artery calcium (CAC) as measured by cardiac computed tomography (CT) is a sensitive marker of subclinical coronary atherosclerosis [6] that can predict future coronary heart disease (CHD) [7] in a wide range of age groups, including asymptomatic young adults [8]. Furthermore, the degree of coronary calcification detected by CT has been correlated with coronary atherosclerosis and coronary stenosis [9,10]. The only study available on the association between egg consumption and CAC did not find any association, but the study was small and information on egg consumption was obtained at least 7 years prior to CAC measurements [11]. Therefore, we examined the association of egg consumption with CAC in a large sample of asymptomatic men and women without a history of CVD or hypercholesterolemia.

2. Methods

2.1. Study population

The Kangbuk Samsung Health Study is a cohort study of Korean men and women who underwent a comprehensive annual or biennial health screening examination at the Kangbuk Samsung Total Healthcare Centers in Seoul and in Suwon, South Korea [12]. The study participants for the current analysis included 30,485 men and women who completed a food frequency questionnaire (FFQ) and underwent a comprehensive health examination including cardiac CT for CAC scoring between March 2011 and April 2013. Annual or biennial health screenings are routinely performed in South Korea because health examinations are mandatory for all workers under the Industrial Safety and Health Law. CAC scoring has become a common CVD screening test in South Korea [12].

We excluded 437 participants with a history of CVD and 5401 participants with a history of hypercholesterolemia (defined as a participant with previous diagnosis of hypercholesterolemia or current use of cholesterol-lowering medication) because of potential changes in egg consumption patterns after these diagnoses. We also excluded 474 participants who had implausible energy consumption levels (beyond 3 standard deviation from the $\log_e$-transformed average energy consumption), and 1559 participants with missing information on egg consumption. The final sample size included 23,417 participants (Fig. 1).

The study complied with the Declaration of Helsinki, and was approved by the Institutional Review Board of the Kangbuk Samsung Hospital. The requirement of informed consent was waived because we only used non-identified retrospective data routinely collected for clinical purposes during health screening examinations.

2.2. Dietary assessment

Diet was assessed at the beginning of the health screening examination using a 103-item self-administered FFQ validated for use in Korea and designed to capture dietary habits during the previous year [13]. The questionnaires were administered on the same day of visit or within 14 days prior to the exam. Participants were asked about their usual consumption frequency for each food type and portion size. The frequency of servings was classified into 9 possible categories, ranging from never or seldom to three or more times per day for foods and from never or seldom to five or more times per day for beverages. The portion size was classified as small, medium, or large. Participants were also asked to report the consumption period (i.e., 3, 6, 9, or 12 months) for seasonal consumption of fruits.

Total consumption of each of the foods and beverages was calculated by multiplying the frequency of consumption by specific portion sizes. Total energy and nutrient intake was calculated by using food composition table developed by the Korean Nutrition Society [14]. For egg consumption, the questionnaire specifically asked whether they ate whole eggs, the yolk only, or the white only. Nutrient composition of one whole egg (50g) used in this study is presented in Table s1. We divided the participants into 5 categories of egg consumption: < 1, $1 - < 2$, $2 - < 4$, $4 - < 7$, and ≥ 7 eggs/wk.

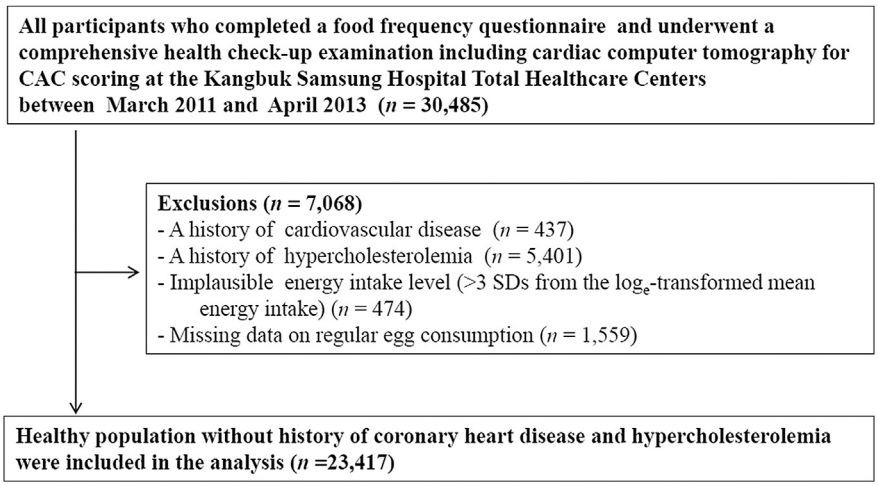

Fig. 1. Flow diagram of study participants. CAC = Coronary artery calcium.