



OPEN ACCESS

Lessons from the trials

# Dietary patterns and their association with acute coronary heart disease: Lessons from the REGARDS Study

Jassim Al Suwaidi\*

## ABSTRACT

Shikany et al used data from 17,418 participants in the REGARDS study, a national, population-based, longitudinal study of white and black adults aged  $\geq 45$  years, enrolled between 2003–2007. They examined 536 acute coronary heart disease events at follow-up (median 5.8 years) in relation to five dietary patterns (Convenience, Plant-based, Sweets, Southern, and Alcohol and Salad). After adjustment for baseline variables, the highest consumers of the Southern pattern experienced a 56% higher hazard for acute CHD.

*Keywords:* coronary artery disease, nutrition, diet, follow-up

Qatar Cardiovascular Research Center  
and Adult Cardiology, Heart Hospital,  
Hamad Medical Corporation, Doha,  
Qatar

\*Email: [jhao1@hmc.org.qa](mailto:jhao1@hmc.org.qa);  
[jalsuwaidi@hotmail.com](mailto:jalsuwaidi@hotmail.com)

[http://dx.doi.org/  
10.5339/gcsp.2015.56](http://dx.doi.org/10.5339/gcsp.2015.56)

Submitted: 14 June 2015  
Accepted: 27 August 2015  
© 2015 Al Suwaidi, licensee  
Bloomsbury Qatar Foundation  
Journals. This is an open access  
article distributed under the terms  
of the Creative Commons  
Attribution license CC BY 4.0, which  
permits unrestricted use,  
distribution and reproduction in any  
medium, provided the original work  
is properly cited.

## INTRODUCTION

Individual foods and nutrients (e.g., red meat and saturated fat) have been studied extensively in relation to coronary heart disease (CHD), however, the relationship between overall diet and CHD is not limited. The investigators use data from the Reasons for Geographic and Racial Differences in Stroke (REGARDS)<sup>1</sup> to test the hypothesis that dietary patterns derived empirically using factor analysis were associated with incident acute CHD.

## THE STUDY

The REGARDS study was a population-based, longitudinal cohort of 30,239 community-dwelling black and white women and men aged  $\geq 45$  years, recruited from 2003–2007 via mail and telephone. The telephone response was 33% and cooperation was 49%. The baseline cohort was 42% black and 55% women. An initial telephone interview was used to survey participants and establish eligibility. Following verbal consent, demographic information and medical history (including risk factor evaluation) was collected. Race was self-classified. An in-home examination then was conducted to perform physical measurements, medication inventory, phlebotomy, and urine collection among those eligible.<sup>2</sup>

## DIETARY ASSESSMENT

Diet was assessed with the Block 98 food frequency questionnaire (FFQ),<sup>3</sup> a validated semi-quantitative FFQ that assessed usual dietary intake of 110 food items (NutrionQuest, Berkeley, CA). For each line item on the FFQ, participants were asked how often, on average, they consumed the food (or group of foods) during the previous year and the quantity of the food consumed was also recorded. The FFQ also included adjustment questions (e.g., inquiring about the type of milk consumed—low fat, non-fat, etc.). The FFQ was self-administered by participants after the in-home visit and mailed to the operations center.

Dietary patterns were divided as follows based on the factor loadings that contributed most highly to each pattern; **Factor 1 “Convenience” pattern:** mixed dishes, pizza, Mexican food, and Chinese food. **Factor 2 “Plant-based” pattern:** vegetables, fruits, fruit juice, cereal, beans, fish, poultry, and yogurt. **Factor 3 “Sweets” pattern:** added sugars, deserts, chocolate, candy, and sweetened breakfast foods. **Factor 4;** this diet reflected a culinary pattern observed in the Southeastern US and hence named the **“Southern” pattern:** added fats, fried food, eggs and egg dishes, organ meats, processed meats, and sugar-sweetened beverages. **Factor 5 “Alcohol and Salad” pattern:** beer, wine, liquor, green leafy vegetables, tomatoes, and salad dressing.

Individuals were also subdivided by quartile of consumption of each dietary pattern.

**Inclusion criteria:** having a name, telephone number, and address in the commercially available nationwide (USA) database from which the sample was collected and age  $\geq 45$  years.

**Exclusion criteria:** race other than white or black, active treatment for cancer, chronic medical conditions precluding long-term participation, cognitive impairment, current or impending residence in a nursing home, inability to communicate in English, missing data on the FFQ, had implausible reported energy intake or CHD at baseline.

**Outcome:** incident acute CHD defined as nonfatal MI or acute CHD death at follow-up.

## RESULTS

The final sample included 17,418 participants, 59% were women, 35% were black, and 56% were residents of the stroke belt.

Compared to participants with a lower consumption of the Southern dietary pattern, participants with a higher consumption of the Southern pattern were more likely to be  $< 65$  years of age, male, black, a non-high school graduate, have an annual household income of  $< \$20,000$ , and a be resident of the stroke belt. Greater consumption of the Southern diet was associated with a higher likelihood of smoking, a lower likelihood of being physically active, and a higher mean BMI and a waist circumference compared to lower consumption. Finally, greater consumption of the Southern pattern was associated with a higher prevalence of hypertension, dyslipidemia, and diabetes.

Higher consumption of the Southern pattern was associated with lower intakes of dietary fiber, vegetables, and fruits, while higher consumption of the Plant-based pattern was associated with higher intake of dietary fiber, vegetables, and whole grain.

Over a median follow-up of 5.8 (2.1) years, 536 cases developed acute CHD, after adjustment for age, sex, race, education, household income, region, energy, smoking, and physical activity, participants with the highest consumption of the Southern pattern experienced a 56% higher hazard of acute CHD (HR 1.56; 95% CI: 1.17–2.08, quartile 4 vs. 1). Adding BMI, waist circumference, and history of hypertension, dyslipidemia, and diabetes to the model attenuated the association somewhat, but a significant association remain (HR = 1.37, 95% CI: 1.01–1.85, P for trend = 0.036). No other dietary pattern was associated with the hazard of acute CHD. A Kaplan-Meier plot demonstrated a lower probability of acute CHD-free survival in the quartile of the highest consumption of the Southern pattern compared to other dietary patterns<sup>2</sup>.

## DISCUSSION

The current study demonstrated that a dietary pattern characterized by added fats, fried food, eggs, organ meats, processed meats, and sugar-sweetened beverages was positively associated with hazard of acute CHD in this population in the US. The other main dietary patterns in the study were not associated with increased risk. The lack of association with the Plant-based pattern was notable, based on the beneficial health effects of the food groups that loaded heavily in this pattern.

The investigators compared their current findings to that of previous reports. It is in agreement with findings from the INTERHEART study<sup>4</sup> and INTERHEART China,<sup>5</sup> the US Health Professionals Follow up Study (HPFS)<sup>6</sup> and Nurses' Health Study (NHS)<sup>7</sup>. However the European Prospective Investigation into Cancer and Nutrition (EPIC)-Netherlands cohort<sup>8</sup> did not find an association between CHD risk and a diet heavily loaded on French fries, fast foods, and sugar-sweetened beverages.

The investigators also compared their findings of no association between Plant-based diet and hazard of CHD to that of previous reports and found consistency with reports from the Danish cohort<sup>9</sup> and Costa Rica.<sup>10</sup> However, HPFS, NHS and Whitehall II<sup>11</sup> studies showed an association between a Plant diet and reduced risk of CHD. The Japan Collaborative Cohort Study<sup>12</sup> reported an association between a vegetable dietary pattern and significant reduction in CHD in women only.

The investigators proposed several mechanisms through which Southern diet may increase the risk of CHD; processed meats have high sodium and nitrate preservative contents which have been shown experimentally to promote atherosclerosis and vascular dysfunction. Sugar-sweetened beverage consumption was positively associated with the risk of CHD, with the risk attributed to increased BMI, increased glycemic load, resulting in insulin resistance,  $\beta$ -cell dysfunction, and inflammation, setting the stage for atherosclerosis.

Finally the investigators discuss the limitations of the study; the subjectivity of factor analysis, the Block 98 FFQ has yet to be validated in REGARDS population, selection bias, dietary data was missing on 28.3%. Of participants free of CHD at baseline, the groups may not be generalizable to groups other than whites and blacks in the US.<sup>2</sup>

## WHAT WE HAVE LEARNED?

A dietary pattern characterized by added fats, fried food, eggs, organ meats, processed meats, and sugar-sweetened beverages was associated with greater risk of acute CHD. This study is also of importance in the Middle East. We and others have reported high prevalence of metabolic syndrome and diabetes mellitus in the community and among patients with cardiovascular diseases.<sup>13,14</sup> Unfortunately studies about dietary patterns in the region are very limited<sup>15,16</sup> and further studies are needed to evaluate and increase awareness of "local" detrimental dietary patterns.

## REFERENCES

- [1] Shikany JM, Safford MM, Newby PK, Durant RW, Brown TM, Judd SE. Southern dietary pattern is associated with hazard of acute coronary heart disease in the reasons of geographic and racial differences in stroke (REGARDS) study. *Circulation*. 2015;132(9):804–814. doi:10.1161/CIRCULATIONAHA.114.014421
- [2] Howard VJ, Cushman M, Pulley L, Gomez CR, Go RC, Prineas RJ, Graham A, Moy CS, Howard G. The reasons for geographic and racial differences in stroke study: Objectives and design. *Neuroepidemiology*. 2005;25:135–143.
- [3] Block G, Hartman AM, Naughton D. A reduced dietary questionnaire: Development and validation. *Epidemiology*. 1990;1(1):58–64.
- [4] Yusuf S, Hawken S, Ôunpuu S, Dans T, Avezum A, Lanas F, McQueen M, Budaj A, Pais P, Varigos J, Lisheng L. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): Case-control study. *The Lancet*. 2004;364(9438):937–952.

- [5] Teo KK, Liu L, Chow CK, Wang X, Islam S, Jiang L, Sanderson JE, Rangarajan S, Yusuf S, INTERHEART Investigators in China. Potentially modifiable risk factors associated with myocardial infarction in China: The INTERHEART China study. *Heart*. 2009;95(22):1857–1864. doi:10.1016/j.cell.2009.07.039
- [6] Hu FB, Rimm EB, Stampfer MJ, Acherio A, Spiegelman D, Willett WC. Prospective study of major dietary patterns and risk of coronary heart disease in men. *Am J Clin Nutr*. 2000;72:912–921.
- [7] Fung TT, Willett WC, Stampfer MJ, Manson JE, Hu FB. Dietary patterns and the risk of coronary heart disease in women. *Arch Intern Med*. 2001;161:1857–1862.
- [8] Stricker MD, Onland-Moret NC, Boer JM, van der Schouw YT, Verschuren WM, May AM, Peeters PH, Beulens JW. Dietary patterns derived from principal component- and k-means cluster analysis: Long-term association with coronary heart disease. *Nutr Metab Cardiovasc Dis*. 2013;23:250–256.
- [9] Osler M, Helms Andreasen A, Heitmann B, Hoidrup S, Gerdes U, Mørch Jørgensen L, Schroll M. Food intake patterns and risk of coronary heart disease: A prospective cohort study examining the use of traditional scoring techniques. *Eur J Clin Nutr*. 2002;56:568–574.
- [10] Martínez-Ortiz JA, Fung TT, Baylin A, Hu FB, Campos H. Dietary patterns and risk of nonfatal acute myocardial infarction in Costa Rican adults. *Eur J Clin Nutr*. 2006;60:770–777.
- [11] Brunner EJ, Mosdol A, Witte DR, Martikainen P, Stafford M, Shipley MJ, Marmot MG. Dietary patterns and 15-y risks of major coronary events, diabetes, and mortality. *Am J Clin Nutr*. 2008;87:1414–1421.
- [12] Maruyama K, Iso H, Date C, Kikuchi S, Watanabe Y, Wada Y, Inaba Y, Tamakoshi A, JACC Study Group. Dietary patterns and risk of cardiovascular deaths among middle-aged Japanese: JACC study. *Nutr Metab Cardiovasc Dis*. 2013;23:519–527.
- [13] Al Suwaidi J, Zubaid M, El-Menyar AA, Singh R, Rashed W, Ridha M, Shehab A, Al-Lawati J, Amin H, Al-Mottareb A. Prevalence of the Metabolic syndrome in patients with acute coronary syndrome in six Middle Eastern countries. *J Clin Hypertens (Greenwich)*. 2010;12:890–899.
- [14] Al Suwaidi J. Acute coronary syndrome in the Middle East: The importance of registries for quality assessment and plans for improvement. *Glob Cardiol Sci Pract*. 2013;2013(1):2–4.
- [15] Fahed AC, El-Hage-Sleiman A-KM, Farhat TI, Nemer GM. Diet, genetics, and disease: A focus on the Middle East and North Africa Region. *J Nutr Metab*. 2012;2012:109037.
- [16] Musiagar AO. Diet and prevention of coronary heart disease in the Arab Middle East. *Med Princ. Practice*. 2002;11(Suppl 2):9–16.