Epidemiology

Dietary Patterns and the Risk of Acute Myocardial Infarction in 52 Countries
Results of the INTERHEART Study

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Background—Diet is a major modifiable risk factor for cardiovascular disease, but it varies markedly in different regions of the world. The objectives of the present study were to assess the association between dietary patterns and acute myocardial infarction (AMI) globally.

Methods and Results—INTERHEART is a standardized case-control study involving participants from 52 countries. The present analysis included 5761 cases and 10 646 control subjects. We identified 3 major dietary patterns using factor analysis: Oriental (high intake of tofu and soy and other sauces), Western (high in fried foods, salty snacks, eggs, and meat), and prudent (high in fruit and vegetables). We observed an inverse association between the prudent pattern and AMI, with higher levels being protective. Compared with the first quartile, the adjusted ORs were 0.78 (95% CI 0.69 to 0.88) for the second quartile, 0.66 (95% CI 0.59 to 0.75) for the third, and 0.70 (95% CI 0.61 to 0.80) for the fourth (P for trend <0.001). The Western pattern showed a U-shaped association with AMI (compared with the first quartile, the adjusted OR for the second quartile was 0.87 [95% CI 0.78 to 0.98], whereas it was 1.12 [95% CI 1.00 to 1.25] for the third quartile and 1.35 [95% CI 1.21 to 1.51] for the fourth quartile; P for trend <0.001), but the Oriental pattern demonstrated no relationship with AMI. Compared with the first quartile, the OR of a dietary risk score derived from meat, salty snacks, fried foods, fruits, green leafy vegetables, cooked vegetables, and other raw vegetables (higher score indicating a poorer diet) increased with each quartile: second quartile 1.29 (95% CI 1.17 to 1.42), third quartile 1.67 (95% CI 1.51 to 1.83), and fourth quartile 1.92 (95% CI 1.74 to 2.11; P for trend <0.001). The adjusted population-attributable risk of AMI for the top 3 quartiles compared with the bottom quartile of the dietary risk score was 30%.

Conclusions—An unhealthy dietary intake, assessed by a simple dietary risk score, increases the risk of AMI globally and accounts for ≈30% of the population-attributable risk. (Circulation. 2008;118:1929-1937.)

Key Words: diet ■ myocardial infarction ■ nutrition ■ cardiovascular diseases ■ risk factors

A

proximately 80% of the global cardiovascular disease (CVD) burden occurs in low- and middle-income countries. Most research examining the relationship between diet and CVD has been conducted among populations of European origin, with little information on diet-based disease risk available from other parts of the world, where the majority of CVD occurs. Diets vary markedly in different regions of the world, and it is not clear whether the results from studies conducted in Western countries are applicable elsewhere. Most research has focused primarily on micronutrients, but such assessments require extensive questionnaires that must be tailored to assess the diverse food consumption in different parts of the world. Dietary intake is a complex exposure variable with a large number of components, with various components influencing the risk of disease in opposing directions (some protective, others harmful). The study of dietary patterns has emerged in nutrition research1,2 because different nutrients may interact with each other and intake of specific foods can cluster, but their patterns vary between different populations. Finally, recommendations for health promotion are more easily conveyed when they are based on patterns of food intake (eg, promoting or avoiding certain foods) rather than on specific nutrients (eg, polyunsaturated fatty acids). Despite the marked variations in diet in different parts of the world, if a pattern of intake of specific food items could be

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*A complete list of the INTERHEART investigators appears in Appendix IV in the Data Supplement.

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related to acute myocardial infarction (AMI), recommendations for healthy diets could become more practical by use of a simple and consistent approach globally.

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The INTERHEART study is a large case-control study of AMI in 52 countries that documents the association of various risk factors with the risk of AMI globally and in individuals from various regions of the world. In the present report, we assess the association between dietary patterns and a simple dietary risk score (DRS) with AMI globally and in different regions of the world.

Methods

Participants

In the INTERHEART study, 12,461 patients with incident cases of AMI from 262 centers in 52 countries representing all geographic regions and 14,637 control subjects free of heart disease were enrolled between February 1999 and March 2003. Centers were requested to recruit consecutive subjects. Patients admitted to the coronary care unit or equivalent cardiology ward of participating centers were screened to identify incident cases of first AMI and enrolled within 24 hours. Details of criteria used for the definition of AMI are provided elsewhere. At least 1 control subject was recruited from each center and matched to every case subject by age (up to 5 years older or younger) and sex. Eligible control subjects were community based (visitor or relative of a patient from another ward, or an unrelated visitor of a cardiac patient) or hospital based. The ethics committees at each participating center approved INTERHEART, and participants provided informed consent.

Procedures

Staff were trained in data collection by use of standard manuals, videotapes, and instructions given at meetings or site visits. Information on demographics (country of origin, first language), socioeconomic factors (household income, education), and other risk factors was recorded. This included information on tobacco use (current smokers were defined as individuals who had smoked any form of tobacco in the past 12 months; former smoking was defined as those who had quit more than 1 year earlier) and physical activity (regular involvement in moderate or vigorous physical activities). Patterns of alcohol consumption and psychosocial stress were also assessed. Anthropometric measures were obtained in duplicate, by the same examiner, and included height, weight, and waist and hip circumferences. Nonfasting blood samples were drawn within 24 hours of the onset of symptoms in AMI case subjects and during the physical examination in control subjects. Blood samples from all centers other than China were shipped to Canada and analyzed in Hamilton for total lipids. The blood samples from China were shipped to Canada and analyzed in Hamilton for total lipids. The ApoA1. The ApoB/ApoA1 ratio was used as an index of abnormal lipids. The blood samples from China were analyzed in a central laboratory in China after standardization with the laboratory in Canada.

We assessed dietary patterns using a simple 19-item qualitative food group frequency questionnaire. A description of the 19 food groups is provided in Appendix 1 (Data Supplement). This food group frequency questionnaire has not been validated against another dietary measure, but it has face validity because the individual items have been related to CVD previously, and its findings are consistent with the known protective effects of fruit and vegetable consumption against CVDs. To assess the reliability of the questionnaire, we re-administered it to 292 control subjects, representing people from all regions of the world. Most food items had correlations in the neighborhood of 0.60 (eg, nuts) to 0.80 (eg, dairy products; P<0.0001), with a range from −0.24 (P<0.0001) for soy and other sauces to 0.86 (P<0.0001) for cooked vegetables.

Statistical Analysis

To minimize confounding of diet-disease relationships, the present analysis was confined to 5761 cases of first AMI and 10,646 control subjects who did not have previous angina, diabetes mellitus, hypertension, or hypercholesterolemia. For the present analysis, extreme values (based on the intake of respective food groups) were truncated to achieve more normal distribution of food group variables. For example, bread intake of >12 times per day was truncated to 12 times per day for subjects who reported higher values. Exploratory factor analysis was used to derive food patterns from the food group frequency questionnaire for all participants in the study. These factors were orthogonally rotated to generate uncorrelated factors. We determined the number of factors to retain on the basis of several criteria that included eigenvalue >1.0, scree test, and factor interpretability, which clearly identified 3 major dietary patterns. We did not use the percentage of variance explained by each factor, because this criterion depends largely on the total number of variables used in generating the factors. Factor scores were created for each subject as the linear combination of the dietary variables weighted by an equivalent of the factor loadings. The analyses were conducted with the factor procedure in SAS. We chose to retain 3 factors for further analyses.

We created quartiles for all 3 dietary patterns generated by the factor analysis. We conducted logistic regression analysis to assess the association between each dietary pattern and AMI, adjusting for the covariates at various levels. Model 1 adjusted for the effects of age and sex, whereas model 2 adjusted for the effects of age, sex,
Dietary Patterns and AMI

Three underlying major factors were identified and subjectively labeled as Oriental, Western, and prudent. The complete factor-loading matrix is presented in Table 1. The first factor was labeled “Oriental” because of its high loading on tofu and soy and other sauces. The second factor was labeled “Western” because of its high loading on fried food, salty snacks, and meat intake. The third dietary factor was labeled “prudent” because of its high loadings on fruit and vegetable intake. Distribution of dietary patterns by regions is presented in Table I in the Data Supplement.

We categorized the dietary patterns into quartiles and observed that the mean age of participants in the first quartile of Oriental dietary pattern was 53.8 (SD 12.5) years, whereas participants in the highest quartile of intake had a mean age of 57.6 (SD 12.0) years ($P<0.0001$). For the Western dietary pattern, participants in the lowest quartile of intake were older than those in the highest quartile of intake ($P<0.0001$). A higher proportion of participants in the highest quartile of prudent dietary pattern intake were physically active (30.8%) than were participants in the lowest quartile of the prudent dietary pattern intake (13.8%; $P<0.0001$). Other results are shown in Table 2.

To understand the association between dietary patterns and biomarkers of AMI, we estimated mean concentrations of ApoB/ApoA1 tertiles, hemoglobin $A_b$ ($Hb A_b$), systolic blood pressure (SBP), and WHR in control subjects (Table 3). We observed an inverse relation between increasing quartiles of intake of Oriental dietary pattern and ApoB/ApoA1 ratio, SBP, and WHR.

### Results

#### Dietary Patterns and AMI

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Table 3. Mean (SD) Plasma Concentrations of Biomarkers of CVD, SBP, and WHR by Quartiles of Dietary Pattern and DRSs for Control Subjects

<table>
<thead>
<tr>
<th>Dietary Patterns</th>
<th>ApoB/ApoA1, mmol/L</th>
<th>%Hb A1c</th>
<th>SBP, mm Hg</th>
<th>WHR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oriental</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quartile 1 (lowest quartile)</td>
<td>0.84 (0.33)</td>
<td>5.73 (0.59)</td>
<td>125.41 (15.18)</td>
<td>0.92 (0.08)</td>
</tr>
<tr>
<td>Quartile 2</td>
<td>0.82 (0.34)</td>
<td>5.72 (0.62)</td>
<td>126.36 (15.44)</td>
<td>0.91 (0.08)</td>
</tr>
<tr>
<td>Quartile 3</td>
<td>0.81 (0.46)</td>
<td>5.77 (0.76)</td>
<td>125.48 (14.68)</td>
<td>0.91 (0.08)</td>
</tr>
<tr>
<td>Quartile 4 (highest quartile)</td>
<td>0.71 (0.28)</td>
<td>5.80 (0.80)</td>
<td>124.73 (14.51)</td>
<td>0.88 (0.08)</td>
</tr>
<tr>
<td><strong>Western</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quartile 1</td>
<td>0.80 (0.41)</td>
<td>5.78 (0.76)</td>
<td>125.99 (14.96)</td>
<td>0.91 (0.08)</td>
</tr>
<tr>
<td>Quartile 2</td>
<td>0.77 (0.35)</td>
<td>5.73 (0.68)</td>
<td>125.63 (15.31)</td>
<td>0.91 (0.08)</td>
</tr>
<tr>
<td>Quartile 3</td>
<td>0.80 (0.36)</td>
<td>5.75 (0.69)</td>
<td>125.09 (14.75)</td>
<td>0.91 (0.08)</td>
</tr>
<tr>
<td>Quartile 4</td>
<td>0.78 (0.31)</td>
<td>5.77 (0.68)</td>
<td>125.20 (14.75)</td>
<td>0.90 (0.09)</td>
</tr>
<tr>
<td><strong>Prudent</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quartile 1</td>
<td>0.78 (0.33)</td>
<td>5.72 (0.71)</td>
<td>124.06 (14.59)</td>
<td>0.91 (0.08)</td>
</tr>
<tr>
<td>Quartile 2</td>
<td>0.78 (0.33)</td>
<td>5.76 (0.76)</td>
<td>125.42 (14.58)</td>
<td>0.91 (0.08)</td>
</tr>
<tr>
<td>Quartile 3</td>
<td>0.80 (0.37)</td>
<td>5.77 (0.69)</td>
<td>125.64 (14.66)</td>
<td>0.91 (0.08)</td>
</tr>
<tr>
<td>Quartile 4</td>
<td>0.80 (0.41)</td>
<td>5.77 (0.64)</td>
<td>126.52 (15.74)</td>
<td>0.90 (0.09)</td>
</tr>
<tr>
<td><strong>Dietary risk scores</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Quartile 1</td>
<td>0.80 (0.43)</td>
<td>5.78 (0.68)</td>
<td>125.94 (15.37)</td>
<td>0.90 (0.08)</td>
</tr>
<tr>
<td>Quartile 2</td>
<td>0.79 (0.35)</td>
<td>5.78 (0.75)</td>
<td>125.24 (15.10)</td>
<td>0.91 (0.08)</td>
</tr>
<tr>
<td>Quartile 3</td>
<td>0.78 (0.34)</td>
<td>5.73 (0.69)</td>
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<tr>
<td>Quartile 4</td>
<td>0.78 (0.29)</td>
<td>5.73 (0.67)</td>
<td>125.12 (14.48)</td>
<td>0.91 (0.08)</td>
</tr>
</tbody>
</table>

We observed an inverse association between the prudent diet and AMI (Figure 1). Compared with the reference group, the adjusted ORs were 0.76 (95% CI 0.68 to 0.85) for the second quartile, 0.66 (95% CI 0.59 to 0.74) for the third quartile, and 0.67 (95% CI 0.59 to 0.76) for the fourth quartile. The association remained significant when the model was adjusted for all of the INTERHEART risk factors: ORs were 0.78 (0.69 to 0.88) for the second quartile, 0.66 (95% CI 0.59 to 0.75) for the third quartile, and 0.70 (95% CI 0.61 to 0.80) for the fourth quartile (P for trend <0.0001).

We observed a U-shaped association between the levels of Western dietary pattern and risk of AMI (Figure 1). The OR for the second quartile versus the first quartile of intake was 0.87 (95% CI 0.78 to 0.98), whereas the third and fourth quartiles were 1.12 (95% CI 1.00 to 1.25) and 1.35 (95% CI 1.21 to 1.51), respectively, after adjustment for selected risk factors (ie, age, sex, region, education, smoking, physical activity, and body mass index). Further adjustment of this pattern for the INTERHEART risk factors resulted in a weaker but positive association between the risk of AMI for the fourth quartile of intake (OR 1.21, 95% CI 1.07 to 1.37; P for trend <0.001). We observed no association between the consumption of an Oriental dietary pattern and risk of AMI. Using quartiles of dietary patterns, we also assessed interaction terms between the regions and AMI and observed significant interactions between the Oriental pattern (P=0.01) and the prudent dietary pattern (P=0.004) and AMI. To further understand the interactions, we then used continuous dietary pattern scores for the Oriental and prudent dietary patterns, which are easier to interpret than the categorized pattern scores. We observed a significant protective association of the Oriental dietary pattern with AMI for the Central/Eastern Europe and China regions. Interaction terms for other regions were not significant for the Oriental dietary pattern. For the prudent dietary factor, we observed a protective association with AMI in China, whereas there was an apparent adverse association in South America. Interaction terms for other regions with AMI were not significant. (Note that any apparent interaction must be interpreted in the context of the large number of such tests conducted. Furthermore, we were unable to explain the apparent discrepancy in South America, which may simply be due to the play of chance because of the numerous subgroups examined.)

**Individual Food Items and AMI**

We selected food items that have been reported in the literature to have a strong association with AMI. We observed significant, inverse, and graded associations between the intake of each of the following food groups and AMI: raw vegetables, green leafy...
vegetables, other cooked vegetables, and fruits. Conversely, we observed a positive association between AMI and the intake of fried foods and salty snacks \( (P<0.001) \) and a weak association between quartiles of meat intake and AMI \( (P 0.08; \text{Table 4}) \).

**DRS and AMI**

We computed mean estimates for biomarkers of risk of AMI across quartiles of DRS and observed an inverse association for ApoB/ApoA1 ratio, Hb A1c, and SBP, whereas there was a positive association between WHR and increasing quartiles of DRS (Table 3). There was a graded and positive association between DRS and risk of AMI. Compared with the lowest quartile, the second quartile of DRS had an OR adjusted for age, sex, and region of 1.29 \( (95\% \ CI 1.17 \text{ to } 1.42) \), the third quartile had an OR of 1.67 \( (95\% \ CI 1.51 \text{ to } 1.83) \), and the fourth quartile had an OR of 1.92 \( (95\% \ CI 1.74 \text{ to } 2.11) \) (Figure 2). The association of the score with AMI varied by region \( (P<0.0001) \) but was directionally similar in all regions. The PAR for this score was 30% \( (95\% \ CI 0.26 \text{ to } 0.35) \) in participants in the INTERHEART study (Figure 3).

**Discussion**

We have characterized the diet of subjects at a global level using a simple dietary questionnaire. We identified 3 major dietary patterns. The prudent diet was clearly associated with a reduced risk of AMI, the Western diet was weakly associated with an increased AMI risk, and the Oriental pattern showed no relationship with AMI risk. The DRS with 7 food items from the dietary questionnaire was positively associated with AMI across all regions of the world. Thirty percent of the PAR for AMI overall was explained by an elevated DRS.

The underlying assumption of statistical data reduction with regard to food intake is that foods eaten together can be characterized as part of a dietary pattern that is more epidemiologically meaningful than are its individual components. The use of factor analysis to define dietary patterns has been investigated by others, and 3 dietary patterns have been commonly reported: the prudent, Western and Mediterranean patterns. Therefore, using the INTERHEART data, we replicated the prudent and Western dietary patterns. We also identified a unique dietary pattern that we labeled as Oriental owing to a higher content of food items typical of an Oriental diet.

Our finding of a protective role of the prudent diet against AMI is similar to other reports indicating that such a dietary pattern protects against diabetes mellitus, CVD, cancer, and mortality. Previous analysis of INTERHEART indicated that consumption of green leafy vegetables, other raw and cooked vegetables, and fruits was associated with reduced odds of AMI \( (OR 0.70, 95\% CI 0.64 \text{ to } 0.77) \) when adjusted for age, sex, and smoking and a 12.9% PAR \( (95\% CI 10.0\% \text{ to } 16.6\%) \). Similar results were observed when the model was adjusted for other INTERHEART risk factors. This is consistent with several other studies.

We observed an adverse role of the Western diet only for the highest quartile of intake, which is supported by similar rela-
tionships observed by others. We postulate that the positive association we observed between Western dietary pattern and AMI only for the highest quartile of intake may be related to regional differences in serving sizes and preparation techniques, which may dampen the observed relationship in a study that involves populations with widely varying diets. We observed significant regional interaction with the Oriental and prudent dietary patterns, but these should be assessed with caution given the large numbers of subgroups examined.

We observed that some biomarkers and physical measures (SBP and WHR) were associated with the dietary patterns (Oriental, prudent, and Western diet), whereas others were not. In addition, the directionality of all of the biomarkers and risk of AMI was not the same. The association between the DRS and some biomarkers (ApoB/ApoA1, Hb A1c, and SBP) was in the expected direction, with improved diet being associated with lower biomarker levels. The WHR association, however, was not in the expected direction and increased with improved dietary intake. The present data suggest that the association between the dietary patterns and AMI are multiple and complex. The present analysis suggests that the association between dietary patterns, in particular the prudent dietary pattern, and DRS with AMI is independent or at the most only explained in part by the risk factors that we measured.

The adverse impact of frequent consumption of fried food and salty snacks has also been reported previously. This could possibly be attributed to the type of fat used in the cooking, with saturated fatty acids being well established as having an adverse association with CVD. The intake of salt has been directly correlated with mean blood pressure levels and prevalence of hypertension, which is an established risk factor of CVD and could partly mediate the association of high salty snack intake and AMI.

We observed a graded dose-response association between quartiles of DRS and risk of AMI overall and across all regions.
of the world. Several studies have created healthy diet indices\textsuperscript{25,26} and examined the association between the dietary score and chronic disease outcomes and mortality in Western populations. Examples of such scores include the Alternate Healthy Eating Index and the Recommended Food Scores.\textsuperscript{25,26} Using the dietary score that we developed, we observed a graded and dose-response association between quartiles of intake and AMI that was independent of all other INTERHEART risk factors. We also calculated overall and region-specific PARs using the DRS. The overall PAR for the risk score was 30\%, which was higher than that reported earlier from the INTERHEART study based on an analysis confined to fruits and vegetables (PAR of 12.9\%).\textsuperscript{3} Although there was a significant variation ($P<0.0001$) in the relationship of the DRS with AMI in different regions, it was directionally consistent across all regions.

INTERHEART was a case-control study, and there may be a possibility of recall bias in dietary intake assessment, which may lead to nondifferential misclassification of the reports of diet from participants. Because data on diet were collected after the diagnosis of AMI, case subjects may have changed their diets owing to preceding conditions (eg, angina or diabetes), which could affect the association of diet with AMI risk. We minimized this possibility by excluding individuals with known preexisting risk factors (eg, diabetes) that could have influenced an individual’s choice of diet. In addition, we acknowledge that because control subjects may not fully represent the population from which the case subjects were derived, this could influence the comparisons. However, the present results were consistent when analysis was restricted to hospital-based versus community-based control subjects, a finding that increases our confidence in the validity of the data. Furthermore, the protective effects of fruit and vegetable intake and the harmful effects of fried foods and meats that we have observed in the present global study have been described consistently in several studies in Western populations that used different study designs eg, cohort and case-control studies. The present study extends these findings and indicates that the same relationships that are observed in Western countries exist in different regions of the world. Because it is not feasible (with regard to either cost or time) to establish large, long-term cohort studies examining the relationship of diet to AMI in every region of the world, our approach (a standardized case-control approach) is the only
feasible one to obtain evidence on the relationship of diet to CVD from multiple populations in a relatively short period of time and at an affordable cost. We did not adjust for total energy intake, because our food intake questionnaire was limited to only 19 items, and consequently, we could not assess dietary energy intake; however, the present findings are unlikely to be affected by such adjustments, because we adjusted our analysis for determinants of total energy intake, such as body size, age, sex, and physical activity. We observed low interclass correlations for soy and other sauces when the dietary questionnaire was readministered to a small group of participants. This is plausible, because the frequency of condiment and spice intake can vary considerably depending on the nature of food preparation.

The main strengths of the present study are the large number of case and control subjects, both men and women, with individuals from all regions of the world, and its global applicability. To avoid potential biases, we excluded from the analysis individuals who may have changed their diet in response to a condition. Nevertheless, their inclusion does not materially alter the main findings of the present study, which indicates that the DRS predicts AMI. The demonstration of a highly significant and graded relationship between the DRS and AMI and the high PAR after adjustment for all other known risk factors suggests that an important part of the beneficial effect of diet may be independent of other known risk factors. This is consistent with the findings of the Nurses Health Study27,28 and the Inter99 Study.29

INTERHEART shows that unhealthy dietary intake, as assessed by a simple DRS, increases the risk of AMI significantly, whereas consumption of a prudent diet is associated with a lower risk. The PAR for AMI worldwide associated with poor dietary intake is substantial. The present work suggests that increased consumption of fruits and vegetables and reduced intake of fried foods, probably related to the type of fat used for frying and salty snacks, is likely to reduce the risk of AMI in all regions of the world.

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Diet is one of the modifiable risk factors of cardiovascular disease globally. The intake of food varies from region to region. It is not clear whether the association between diet (as assessed by dietary patterns and dietary scores) and acute myocardial infarction (AMI) is the same or different in various regions of the world. This analysis included participants from 52 countries (5761 case subjects with AMI and 10 646 control subjects). Using factor analysis, we identified 3 major dietary patterns: Oriental (high intake of tofu and soy and other sauces), Western (high in fried foods, salty snacks, eggs, and meat), and prudent (high in fruit and vegetables). A higher intake of the prudent diet pattern was related to a 30% reduction in the risk of having an AMI globally in every region of the world. A higher intake of the Western diet pattern was associated with a 35% increased risk of having an AMI globally and in every region of the world, whereas there was no association between the Oriental diet pattern and AMI. We also created a dietary risk score (derived from meat, salty snacks, fried foods, fruits, green leafy vegetables, cooked vegetables, and raw vegetables) in which a higher score indicated a poorer diet. A higher score was associated with as much as a 92% increased risk of AMI. The population-attributable risk of AMI for the top 3 quartiles compared with the bottom quartile of the dietary risk score was 30%. An unhealthy dietary intake increases the risk of AMI globally. Nutrition advice to prevent AMI should promote higher intake of a prudent diet globally.
Dietary Patterns and the Risk of Acute Myocardial Infarction in 52 Countries: Results of the INTERHEART Study
Romaina Iqbal, Sonia Anand, Stephanie Ounpuu, Shofiqul Islam, Xiaohe Zhang, Sumathy Rangarajan, Jephat Chifamba, Ali Al-Hinai, Matyas Keltai and Salim Yusuf
on behalf of the INTERHEART Study Investigators

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